Lysack, W. 1984.

Data from the 1983 Lake Winnipeg Fish Stock Assessment Program.

MS Report No. 84-7.

Manitoba
Natural Resources
Fisheries

89-00731/

Lysack, W. 1984.

Data from the 1983 Lake Winnipeg Fish Stock Assessment Program.

Manitoba Department of Natural Resources.
Fisheries MS Report No. 84-7.

INTRODUCTION

This report presents the results of the fifth annual fish stock assessment program on Lake Winnipeg. This program was initiated in 1979 in response to a need for a standardized stock assessment program so that commercial fishery effects on population dynamics could be elucidated (Lysack 1980, 1981, 1982, 1983).

The objectives of this study were to:

1. describe mortality, maturity and growth regimes of walleye, sauger and whitefish stocks.
2. compare effects of various mesh sizes on the biomasses of walleye, sauger and whitefish caught in the three major areas of Lake Winnipeg.
3. compare age compositions, mean ages and mortality rates if commercially caught walleyes, saugers and whitefish from the three major areas on Lake Winnipeg.

METHODS AND MATERIALS

The two major components of the annual stock assessment program on Lake Winnipeg are experimental netting and commercial sampling.

Experimental netting

Experimental gangs of gillnets were set at thirty four stations on Lake Winnipeg during the summer of 1983 (Fig. 1, Table 1). One or two gangs of gillnets were set at each station for one overnight period (16 - 18 hours). The gang was composed of the following mesh sizes: 7. 62 cm. (3 in.), 8.26 cm. (3.25 in.), 8.89 cm. (3.5 in.), 9.53 cm. (3.75 in.), 10.16 cm. (4 in.), and 10.8 cm. (4.25 in.). A 12.70 cm. (5 in.) net and a 13.34 cm. (5.25 in.) net were added to the gang for sets 16 - 34 (Fig. 1). Each net in the gang was 45.72 m. long and approximately 1.83 m (2yd.) deep.

Walleyes, saugers and whitefish caught in experimental gangs were processed as described by Lysack (1980).

Commercial sampling

Commercial catches were sampled during the summer and fall commercial fishing seasons (Table 2, Fig. 1). A minimum of 250 fish of each species were sampled during each excursion. Fish were arbitrarily selected from fishermen's catches and were processed in the same manner as experimentally netted fish except that sex and state of maturity were not determined.

Calculations

Routine statistical analyses were performed according to Snedecor and Cochran (1967). Total mortality rates, Z, were calculated according to Robson and Chapman (1961) and were also estimated by least squares regression analysis of the descending limbs of catch curves.

Data were pooled according to the legal minimum commercial mesh size permitted in each major area of Lake Winnipeg: data from experimental gangs 1 - 15 comprised the south basin pool, data from experimental gangs 16 - 20 comprised the channel pool and data from experimental gangs 21 - 34 comprised the north basin pool. The legal minimum commercial mesh sizes permitted in these three major areas are: 3 inch in the south basin, 3.75 inch in the channel and 4.25 inch in the north basin. Commercial sampling data were pooled accordingly: data from Gimli and Selkirk comprised the south basin pool, data from Matheson Is. and Berens River comprised the channel pool and data from Dauphin River, Gull Bay, Grand Rapids, Big Black River, George Is. and Warren Landing comprised the north basin pool.

Temporal changes in frequencies of mature fish were described using a logistic model:

$$Y_x = \frac{k}{1 + e^{-b(x - x_o)}}$$

where y_x = frequency of mature fish among all fish aged x

k = frequency of mature fish among the oldest age groups

x_o = age at inflection point

b = slope

It was assumed that K = 100%. To facilitate fitting a linear regression, data were transformed by:

$$-\log_e \frac{k - y}{y} = -bX_o + bX$$

Values of Y approaching unity or zero were deleted.

Von Bertalanffy growth curves were derived as described by Ricker (1975). The mean biomass per mesh in each major area of the lake was calculated as follows:

$$\text{Mean biomass net}^{-1} = \frac{\Sigma w}{n}$$

where Σw = sum of all the individual weights of fish of a species caught in a specific mesh in all gangs set in an area.

n = number of gangs set in an area.

In cases where not all fish caught in a gang were sampled (Table 3), the number of unsampled fish were added to the number of sampled fish and this sum was multiplied by the mean individual weight to estimate Σw.

RESULTS

Experimental netting

Maturity regimes

The maturity schedules of Lake Winnipeg walleyes (Table 4), saugers (Table 5), and whitefish (Table 6) were used to derive age-specific maturity curves of these species from the three major areas of the lake (Table 7, Figs. 2-4). Age-specific mean lengths and weights of immature and mature male and female walleyes, saugers and whitefish are listed on Tables 8-10 respectively. Sex-specific growth curves are listed of immature and mature walleyes (Fig. 5), saugers (Fig. 6) and whitefish (Fig. 7) indicate that maturation is a size-specific process. Mean lengths corresponding to ages used to derive the maturity curves depicted in Figs. 2-4 were plotted against transformed maturity frequencies in an attempt to derive size-specific maturity curves Fig. 8-10). Mean length and maturity were not significantly related for walleye and sauger females (Table 11). Results of various analyses of covariance performed on maturity curves are listed on Table 12.

Growth regimes

Age-specific mean fork lengths and mean-weights of walleyes (Table 13), saugers (Table 14) and whitefish (Table 15) were used to derive length-weight relationships (Table 16, Figs. 11-13). Walford plots are listed on Table 17 and depicted in Figs. 14-19. Regressions of $\log_e (L_\infty - \ell_t)$ versus t(years) (Figs. 20-22) are listed on Table 18. Exponential growth curves (Figs. 23-25) and von Bertalanffy growth curves (Figs. 26-28 are listed on Table 19. Analyses of covariance

revealed significant differences (P=0.05) among slopes but not elevations of walleye and sauger exponential growth curves from the major areas (Table 20). Regressions of $\log_e(L_\infty - \ell_t)$ versus t were considered representative of the von Bertalanffy growth curve since they provided estimates of k and t_o values (Table 18, 19). Analysis of covariance revealed significant differences among both slopes and elevations of sauger von Bertalanffy growth curves for northern, channel southern stocks (Table 20).

Mesh size effects

Age compositions, sizes, maturity frequencies, biomasses and mean numbers of fish caught in the various meshes comprising the experimental gang are listed on Tables 21-26 and plotted on Figs. 29-46.

Age compositions, catch curves and mortality rates.

Age compositions and catch curves of experimentally caught walleyes, saugers and whitefish are plotted on Figs. 47-52. Mortality and survival rates derived from these catch curves are listed on Table 27.

Commercial sampling

Age compositions and catch curves of commercially caught fish sampled from the major areas of Lake Winnipeg during the summer and fall fisheries are plotted on Figs. 53-58. Mortality and survival rates derived from these catch curves are listed on Table 27. Table 28 lists age compositions, mean lengths, mean weights and mean weighted ages of commercially caught fish. Differences between mean ages of commercially caught fish and mean ages of maturity are listed on Table 29. Appendix A contains age compositions, sizes and mortality rates of commercially caught fish from the various management areas listed on Table 2.

REFERENCES

Lysack, W. 1980. 1979 Lake Winnipeg fish stock assessment program. Man. Dept. Nat. Res. MS Rep. No. 80-30, 118p.

_____. 1981. 1980 Lake Winnipeg fish stock assessment program. Man. Dept. Nat. Res. MS Rep. No. 81-20, 67p.

_____. 1982. 1981 Lake Winnipeg fish stock assessment program. Man. Dept. Nat. Res. MS Rep. No. 82-28, 99p.

_____. 1983. Data from the 1982 Lake Winnipeg fish stock assessment program. Man. Dept. Nat. Res. MS Rep. No. 83-20, 112p.

Ricker, W. E. 1975. Computation and interpretation of biological stastics of fish populations. Bull. Fish. Res. Board Can. 119: 382p.

Robson, D. S., and D. G. Chapman. 1961 Catch curves and mortality rates. Trans. Am. Fish. Soc. 90: 181 - 189.

Snedecor, G. W., and W. G. Cochran. 1967. Statistical Methods. 6th Ed. Iowa State Univ. Press, Iowa. 593p.

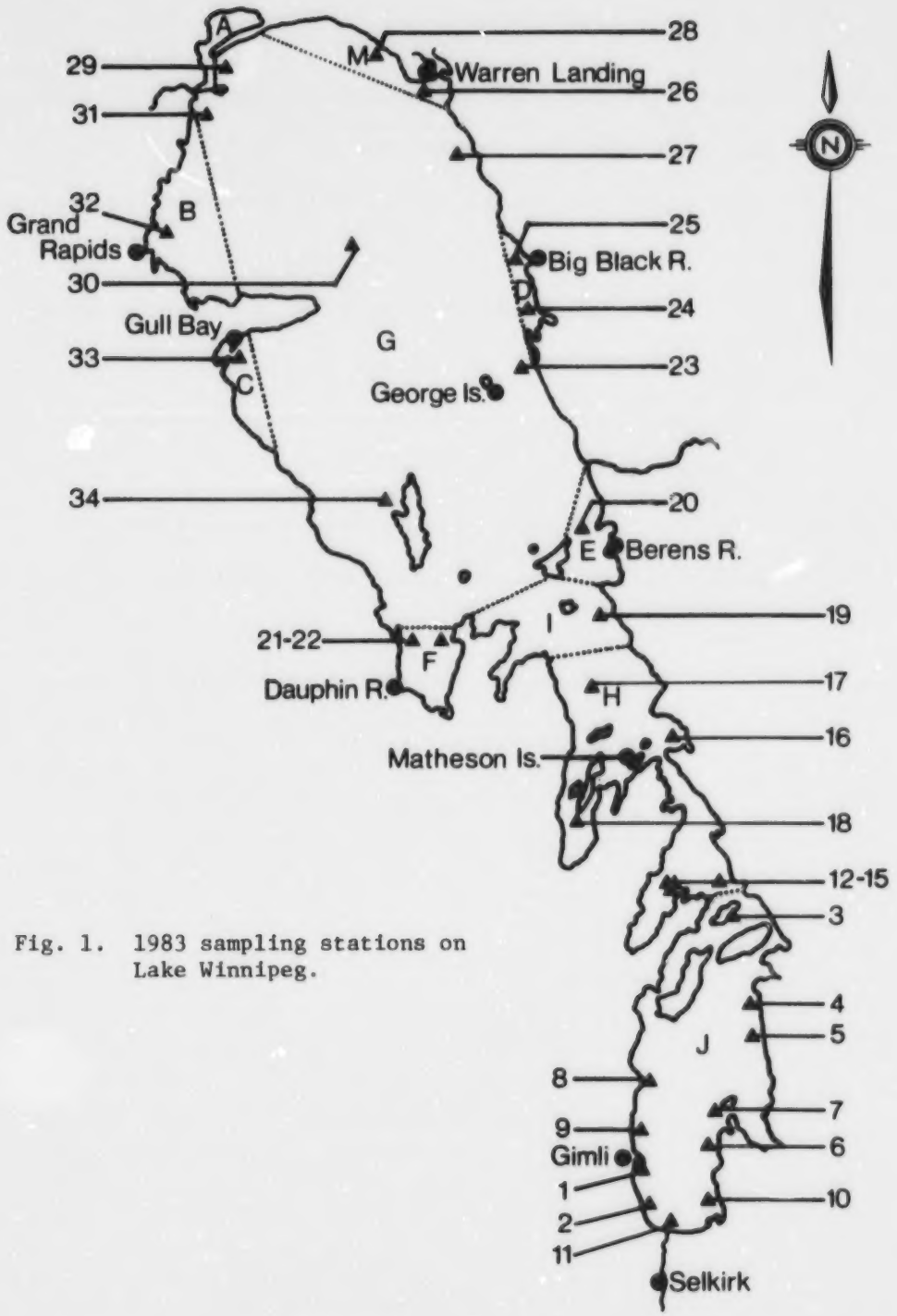

Fig. 1. 1983 sampling stations on Lake Winnipeg.

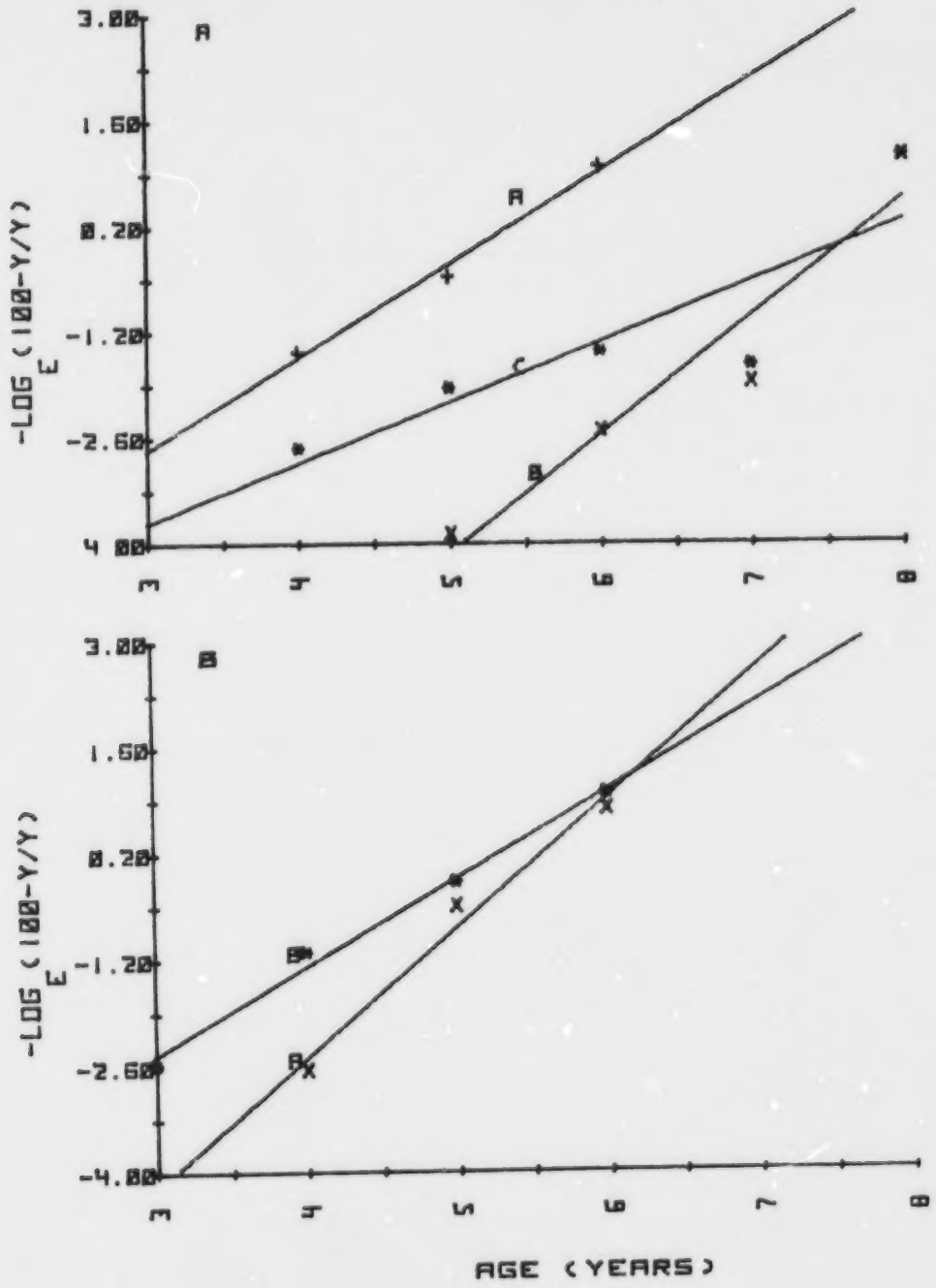

Fig. 2. Age-specific maturity curves of walleyes.

A. Northern walleye males (Curve A), females (Curve B) and combined sexes (Curve C).

B. Southern walleye females (Curve A) and combined sexes (Curve B).

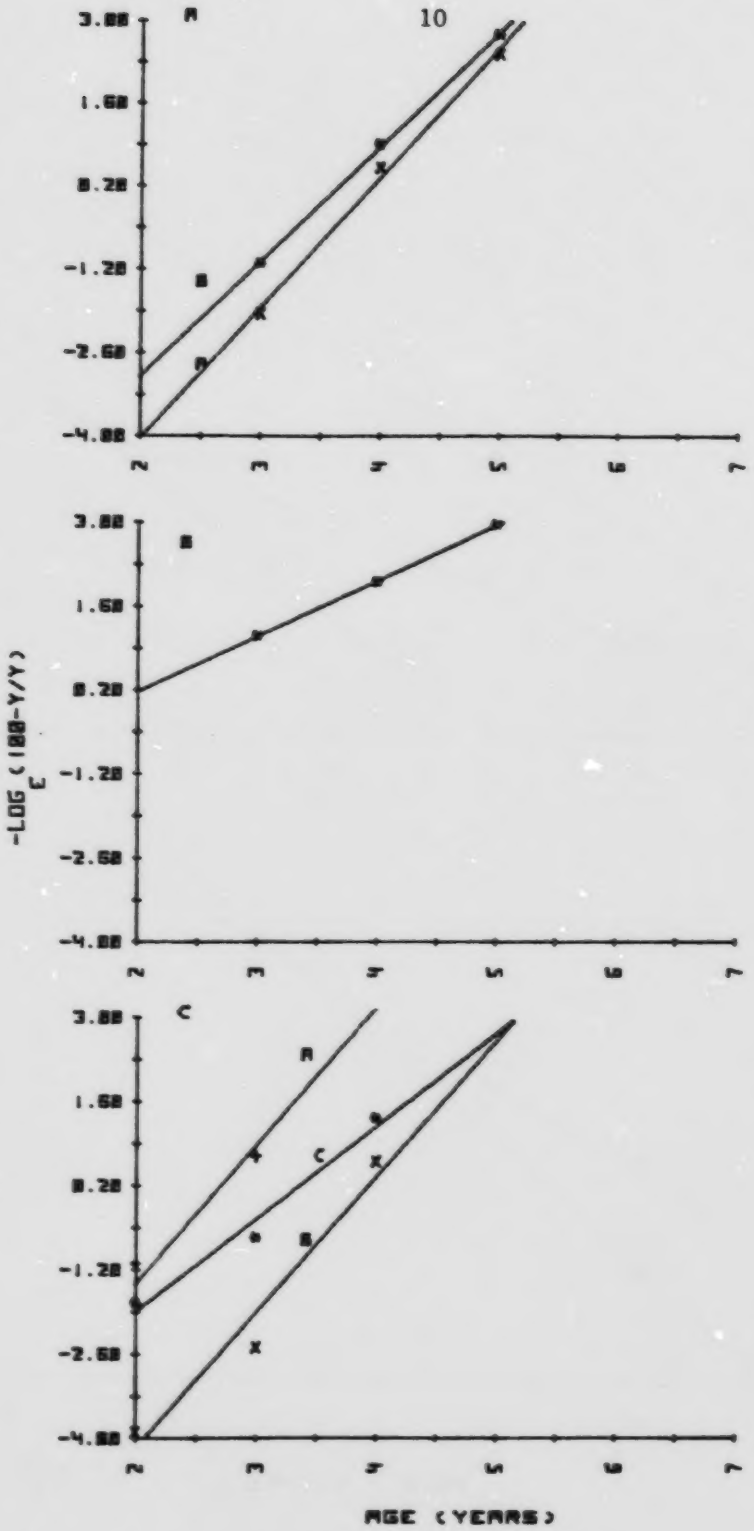

Fig. 3. Age-specific maturity curves of saugers.

A. Northern sauger females (Curve A) and combined sexes (Curve B).

B. Channel sauger combined sexes.

C. Southern sauger males (Curve A), females (Curve B) and combined sexes (Curve C).

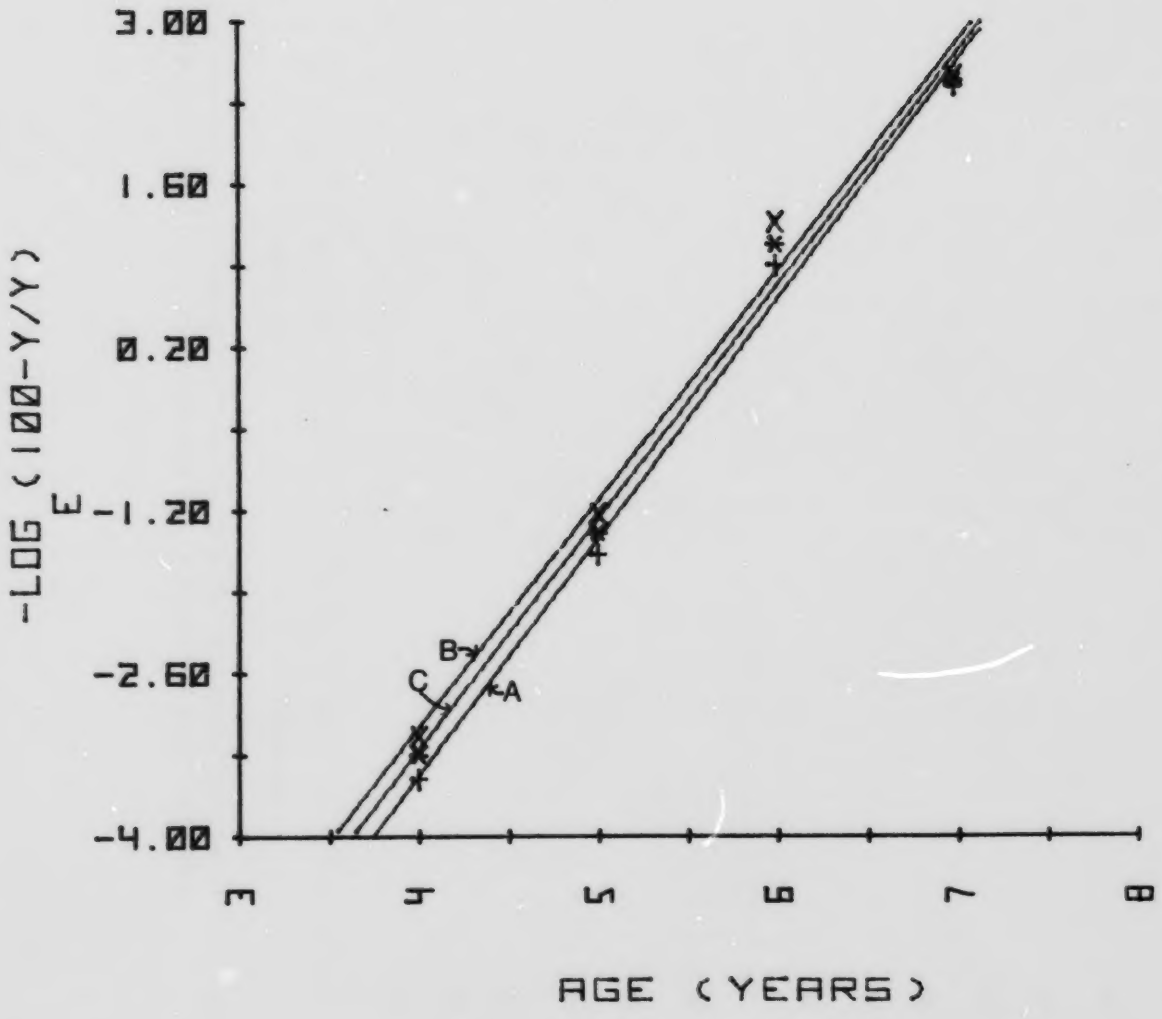

Fig. 4. Age-specific maturity curves of males (A), females (B) and combined sexes (C) whitefish.

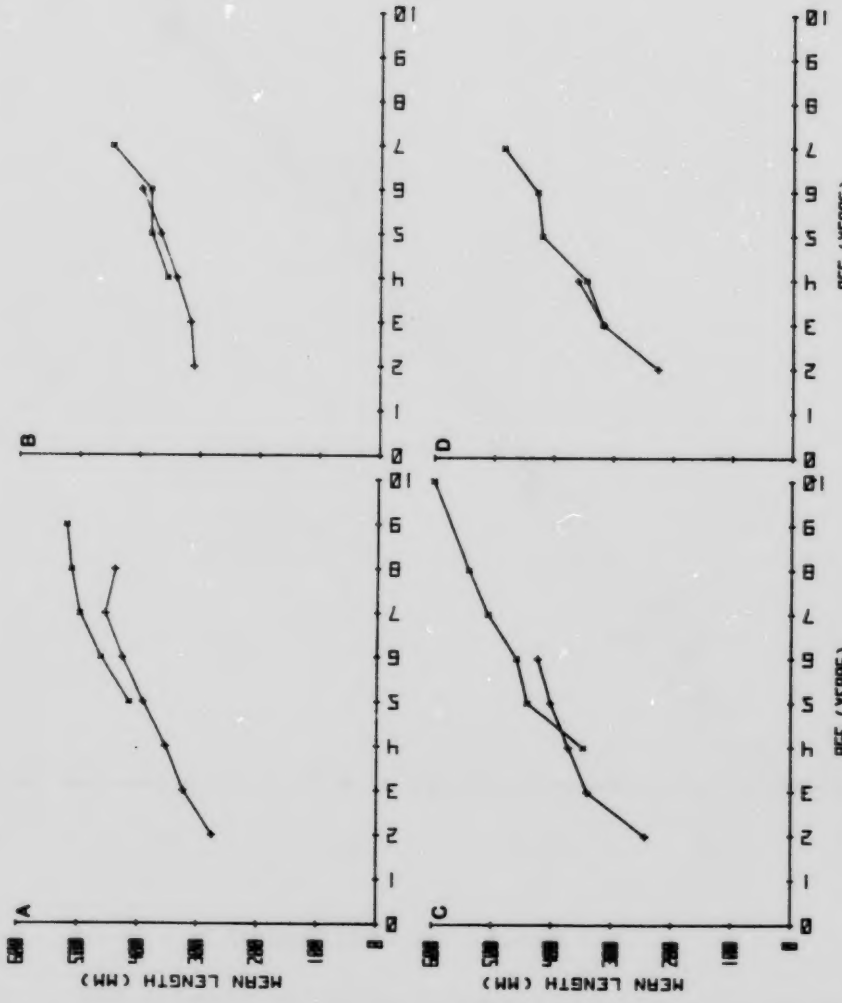

Fig. 5. Growth of immature (+) and mature (x) female (A,C) and male (B,D) walleyes from northern (A,B) and southern (C,D) Lake Winnipeg.

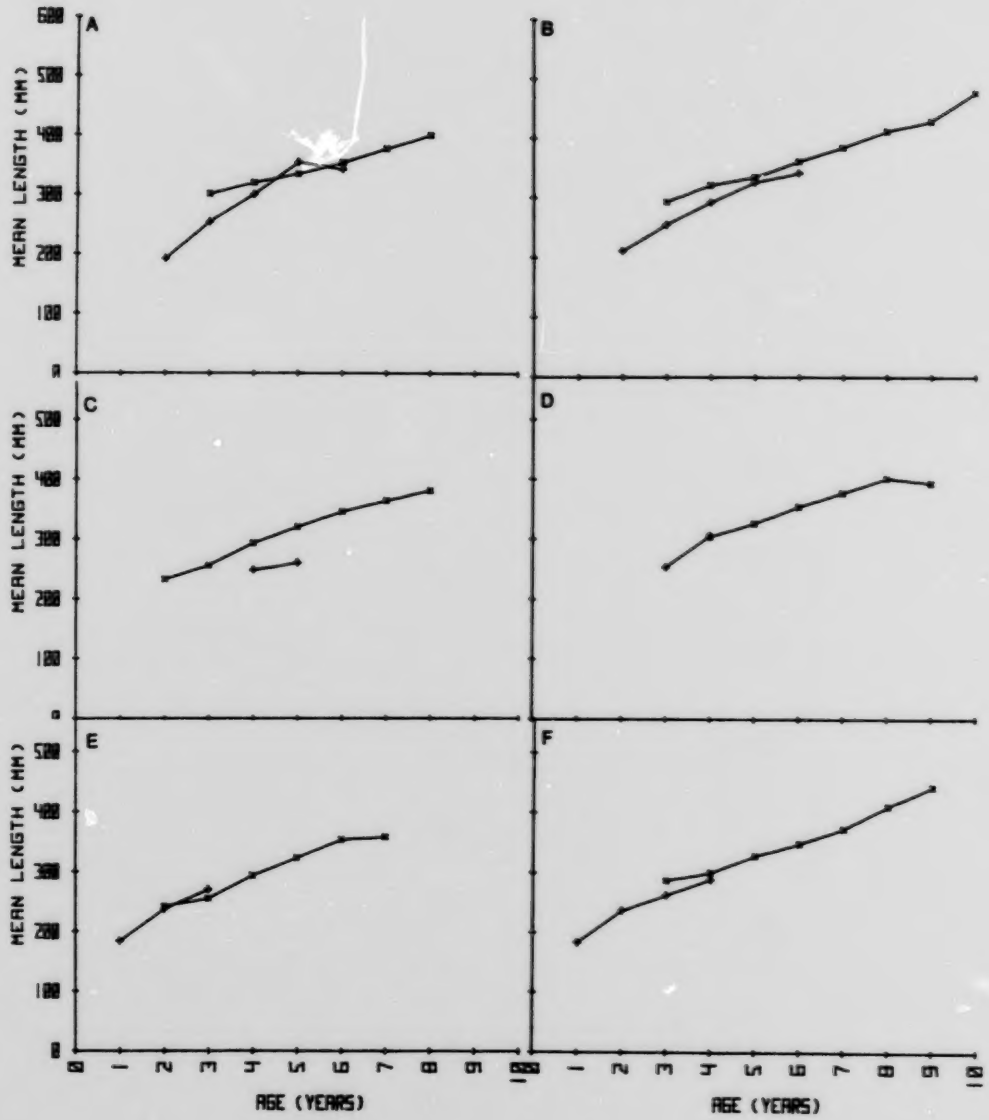

Fig. 6. Growth of immature (+) and mature (x) male (A,C,E,) and female (B,D,F,) saugers from the north basin (A,B) channel (C,D) and south basin (E,F) of Lake Winnipeg.

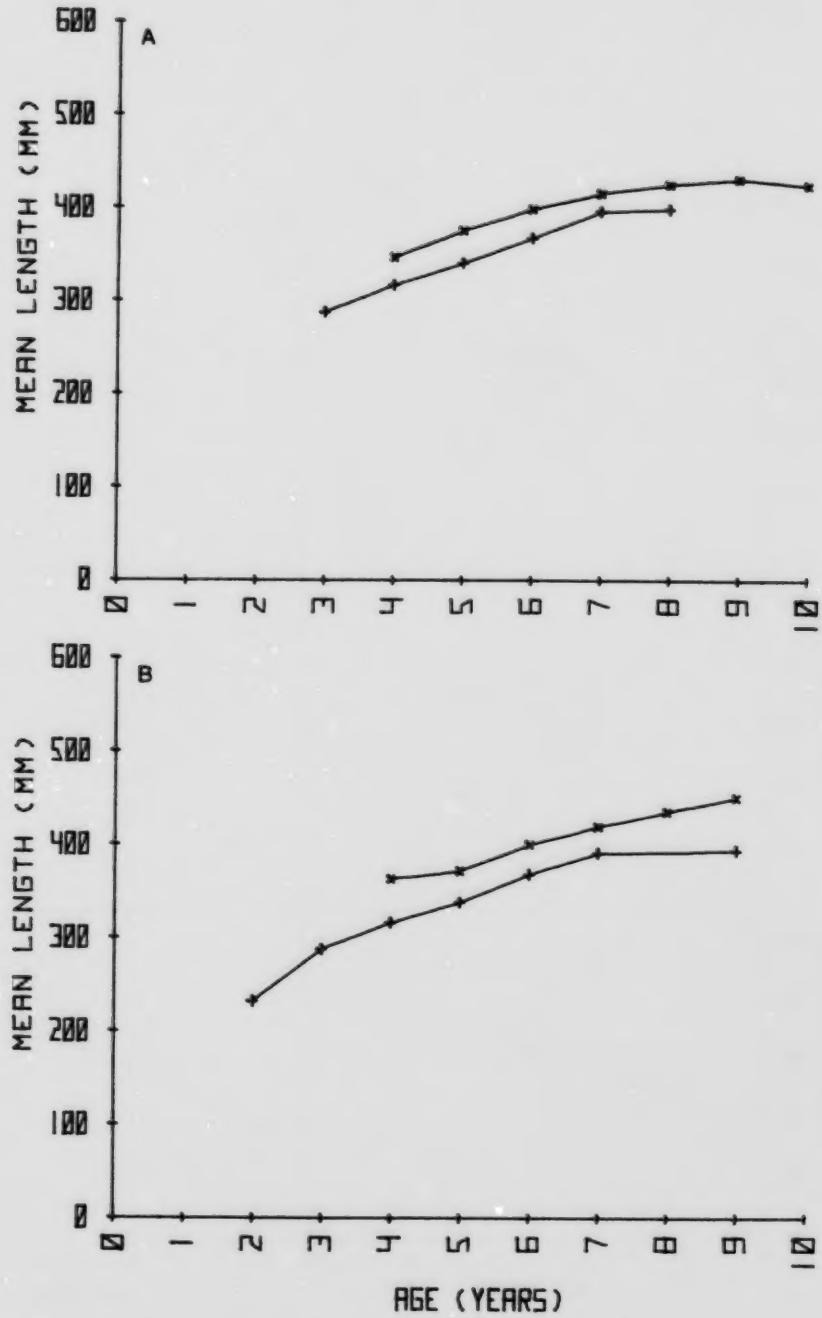

Fig. 7. Growth of immature (+) and mature (x) male (A) and female (B) whitefish.

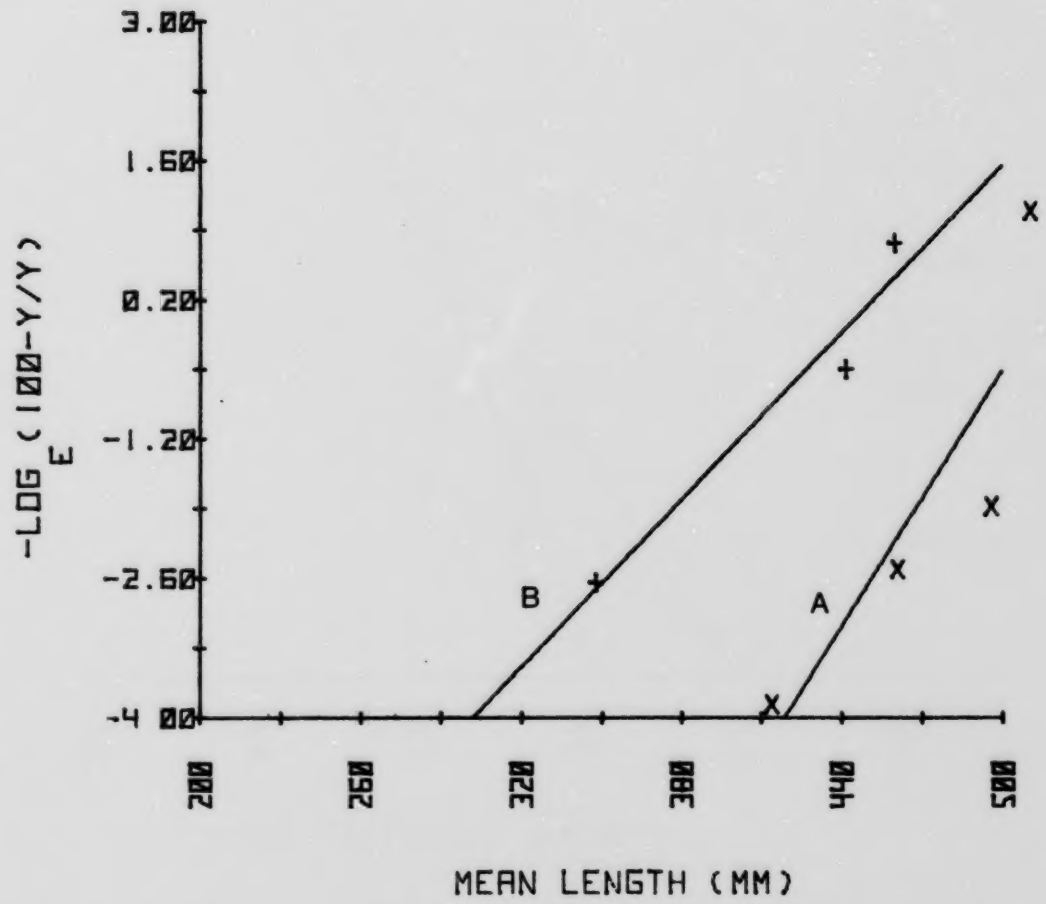

Fig. 8. Size-specific maturity curves of northern (A) and southern (B) walleye females.

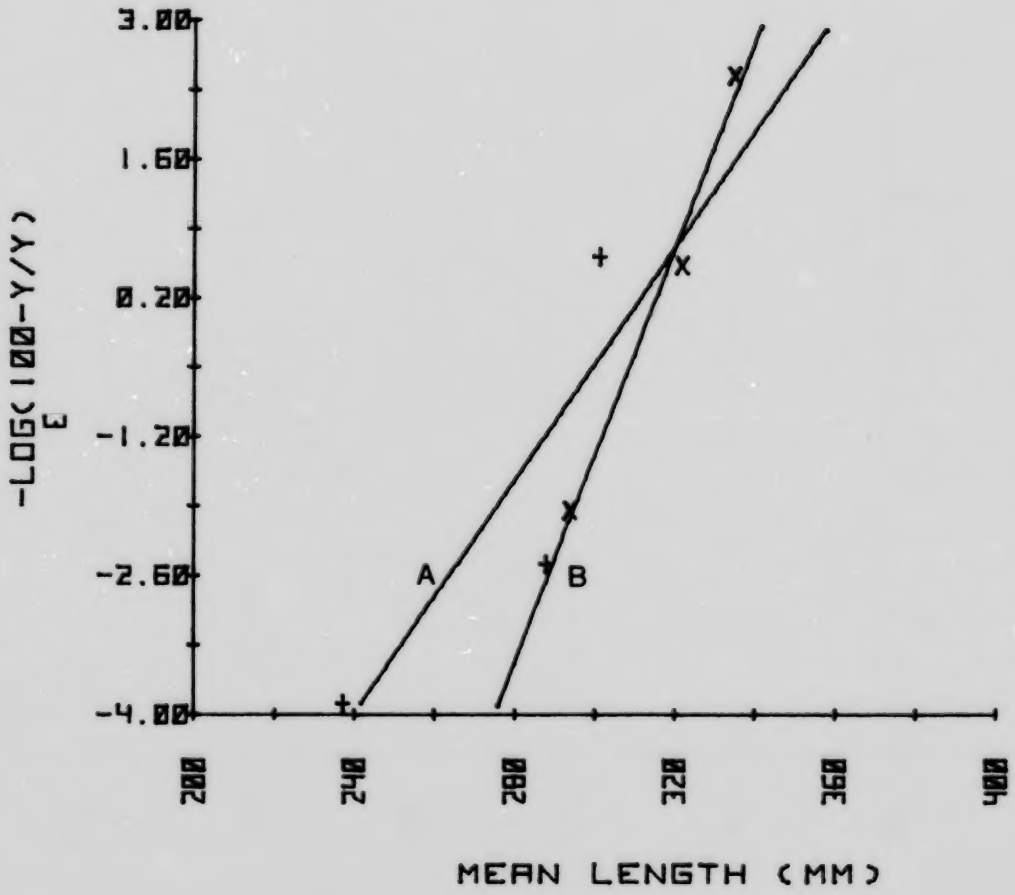

Fig. 9. Size-specific maturity curves of northern (A) and southern (B) sauger females.

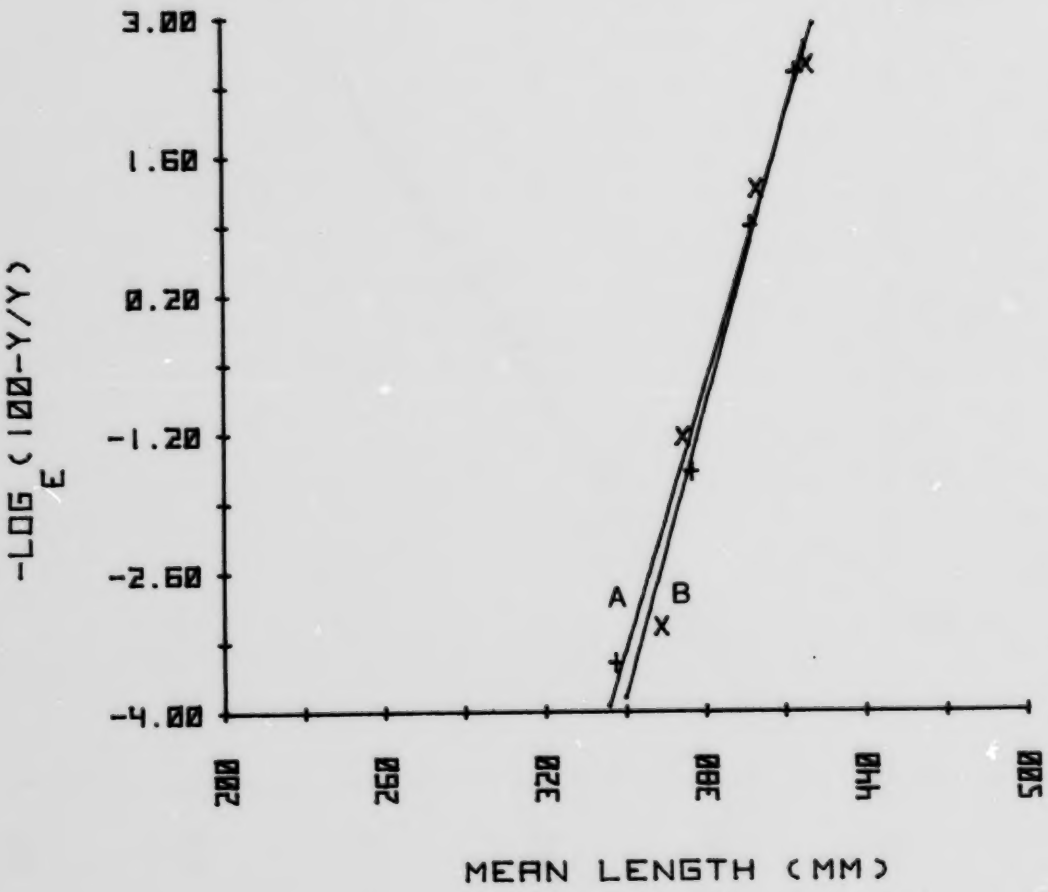

Fig. 10. Size-specific maturity curves of whitefish males (A) and females (B).

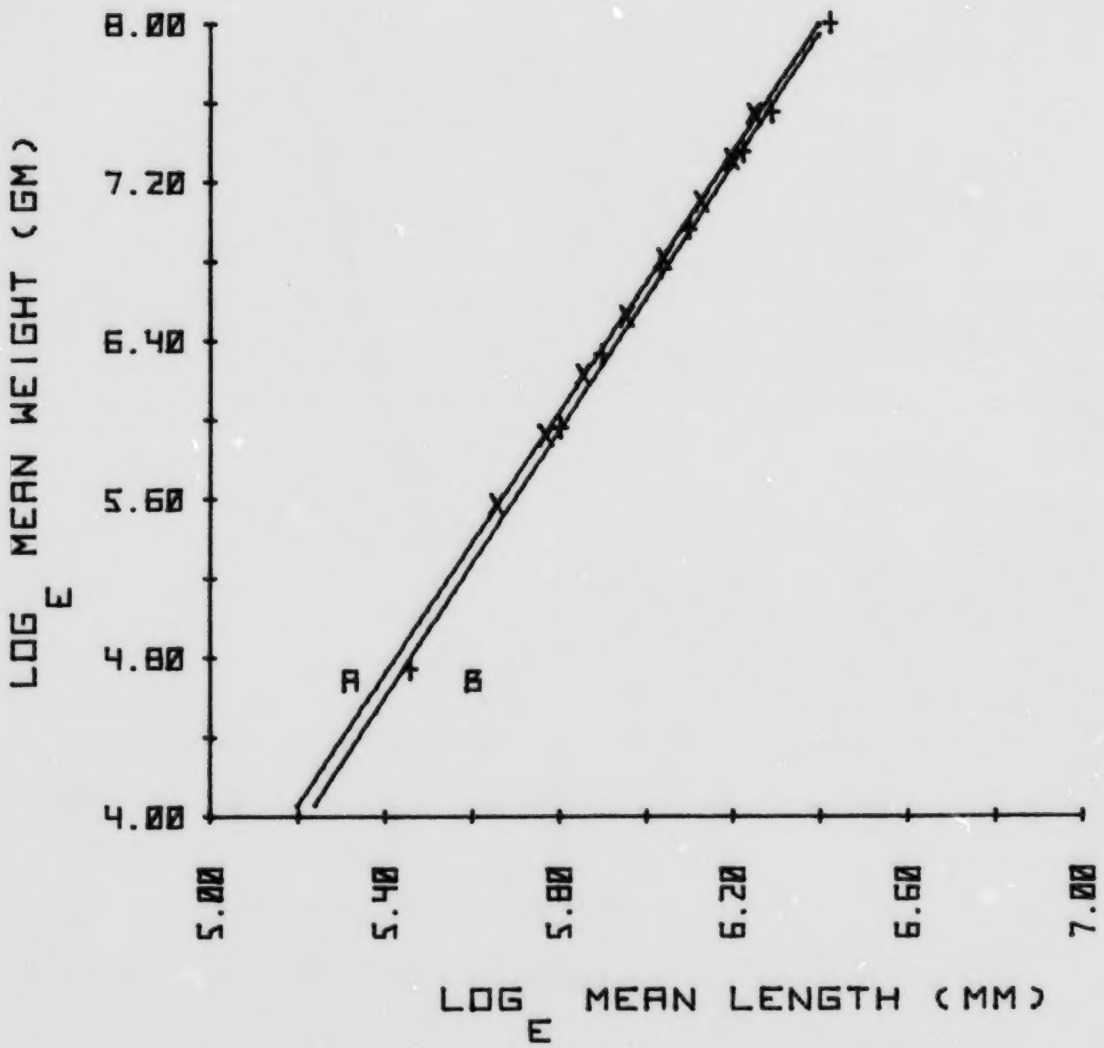

Fig. 11. Age-specific mean length - mean weight curves for northern (A) and southern (B) walleyes.

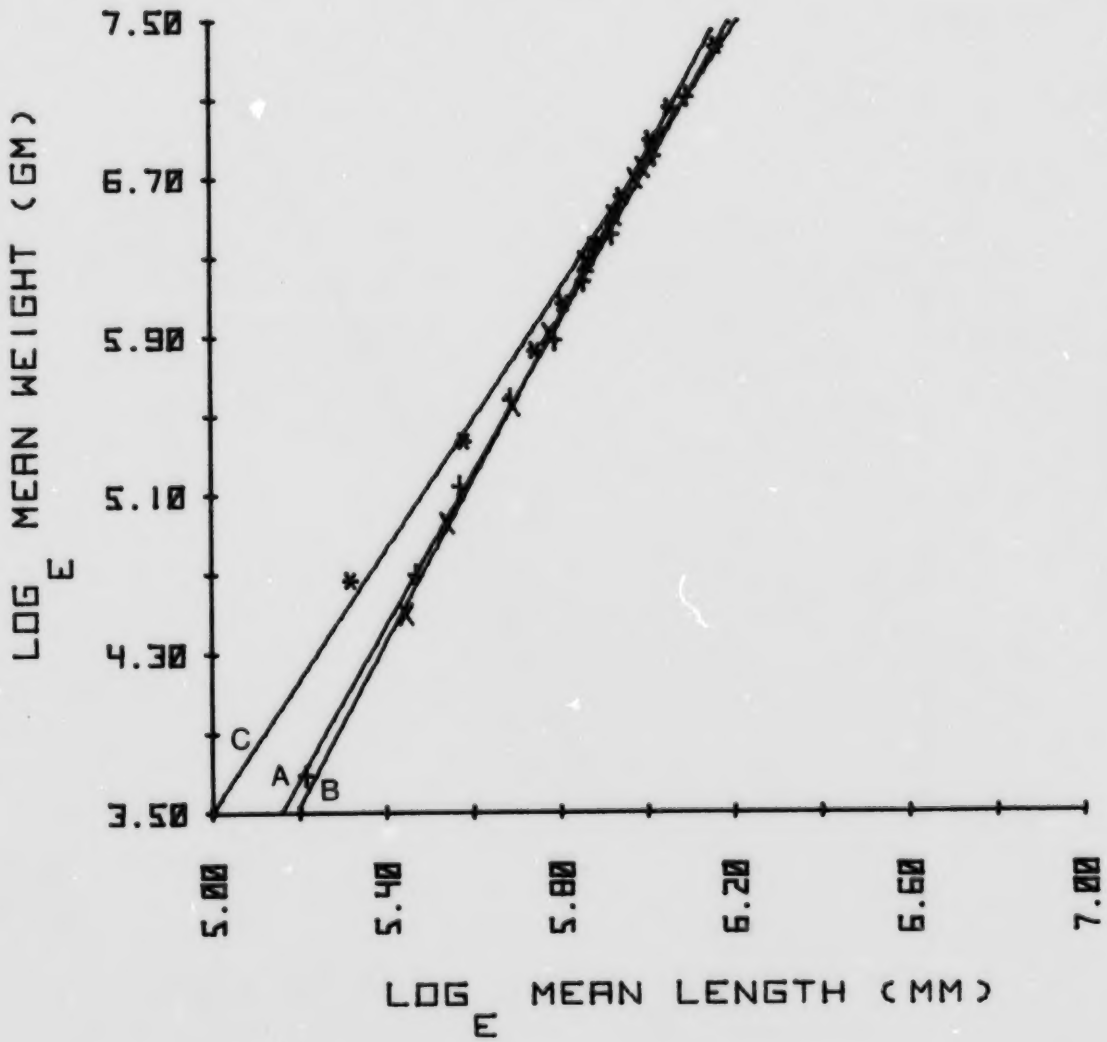

Fig. 12. Age-specific mean length - mean weight curves for southern (A), Channel (B) and northern (C) saugers.

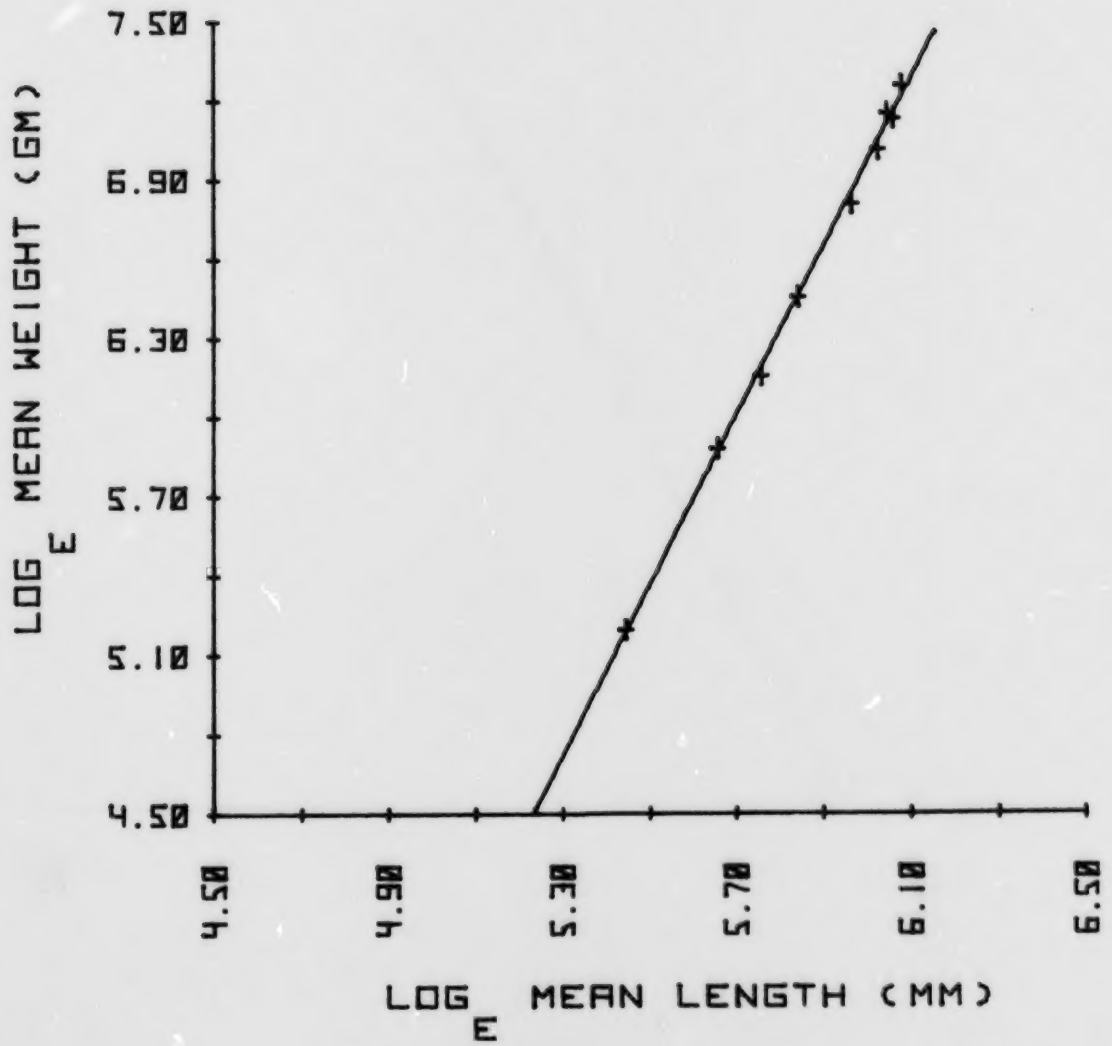

Fig. 13. Age-specific mean length - mean weight curve for northern whitefish.

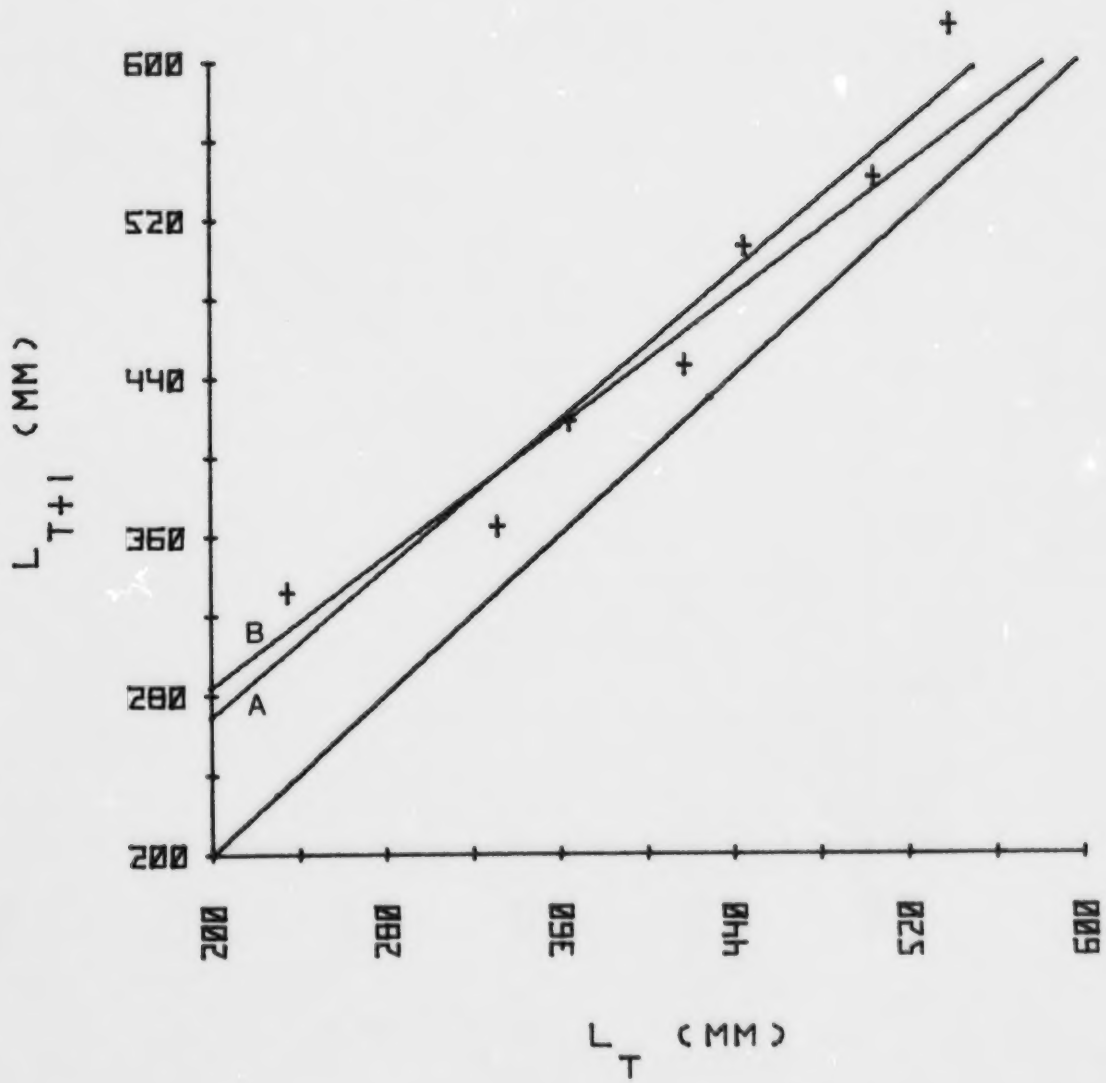

Fig. 14. Walford plot for southern walleyes. Curve A - all points, Curve B - last point deleted.

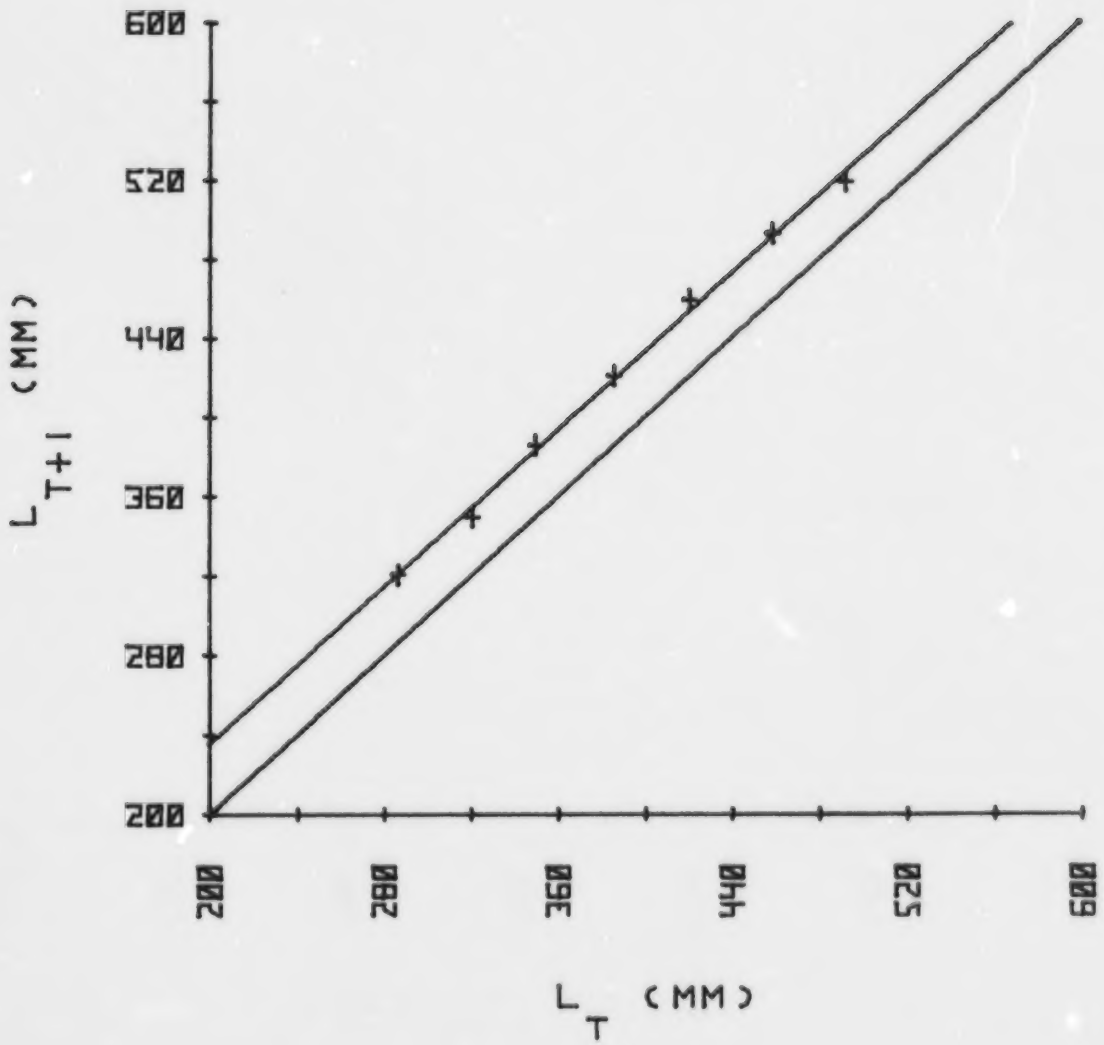

Fig. 15. Walford plot for northern walleyes.

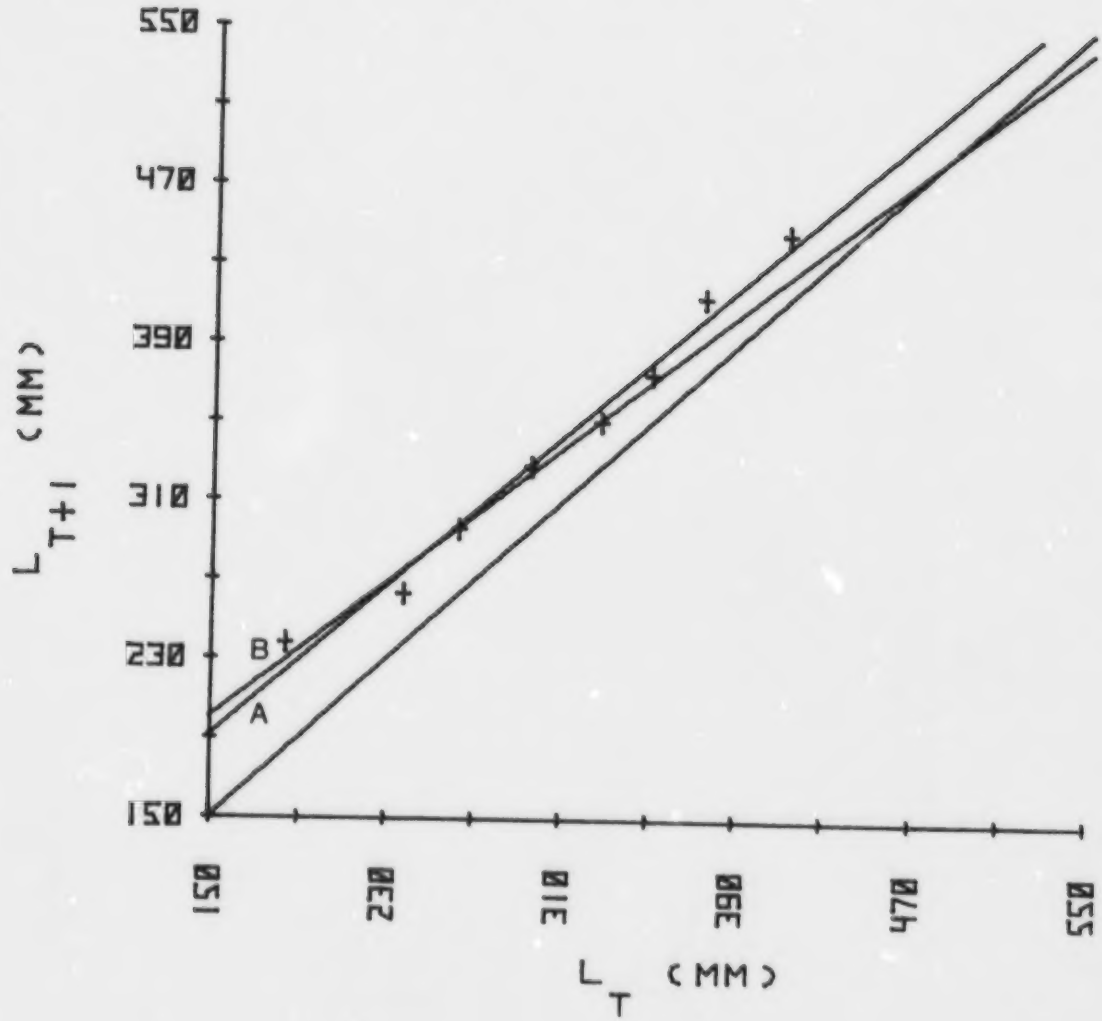

Fig. 16. Walford plot for southern saugers. Curve A - all points, Curve B - last two points deleted.

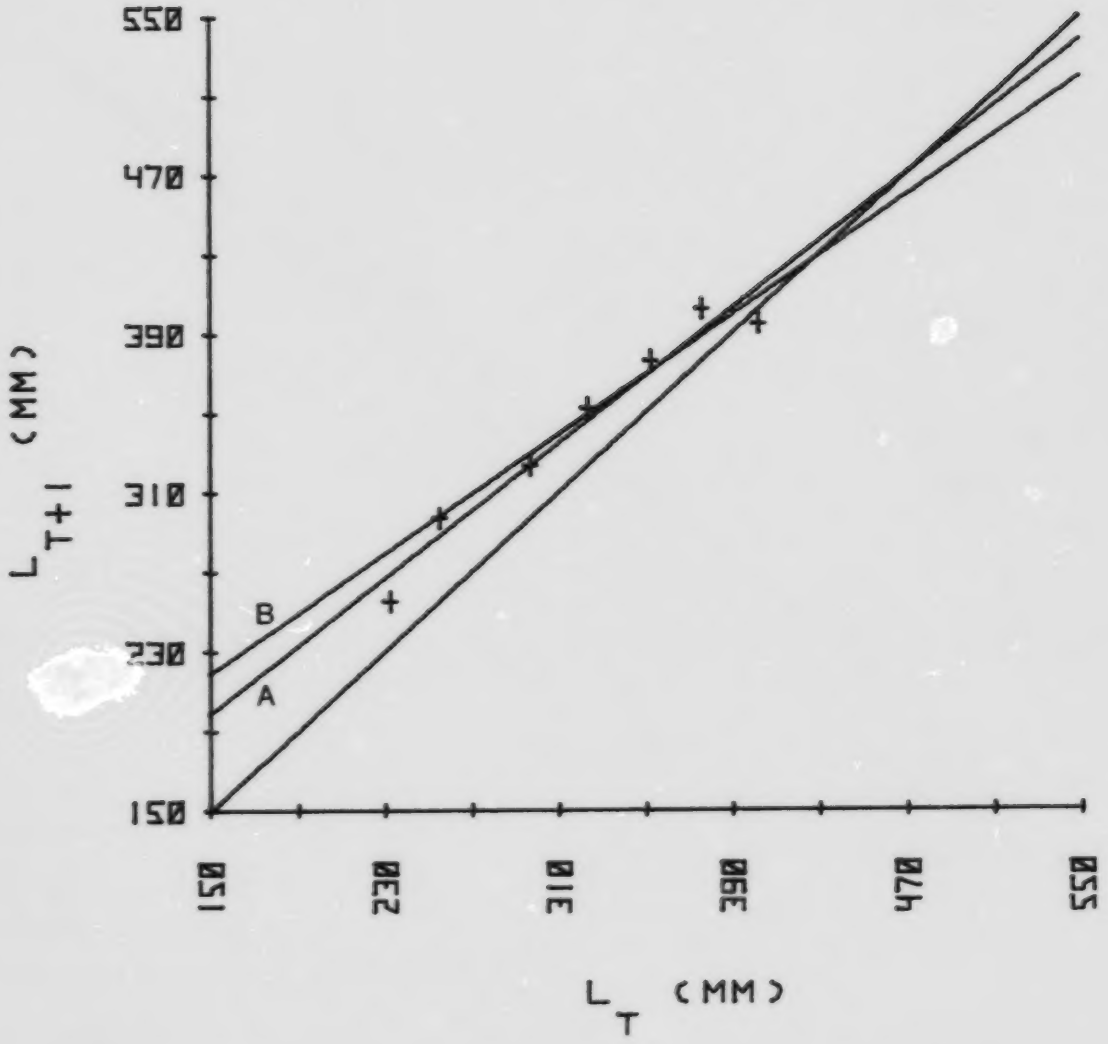

Fig. 17. Walford plot for channel saugers. Curve A - all points, Curve B - first point deleted.

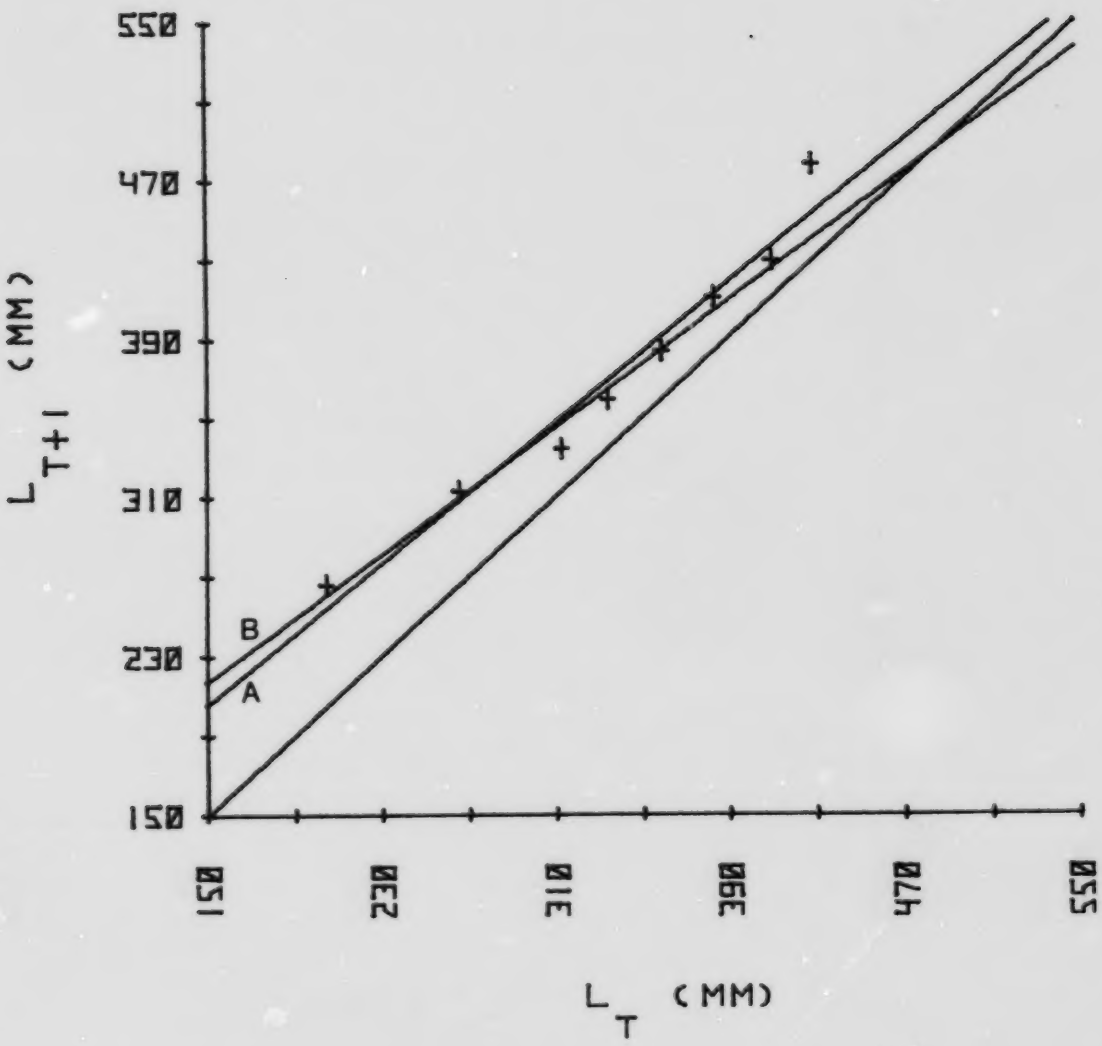

Fig. 18. Walford plot for northern saugers. Curve A - all points, Curve B - last point deleted.

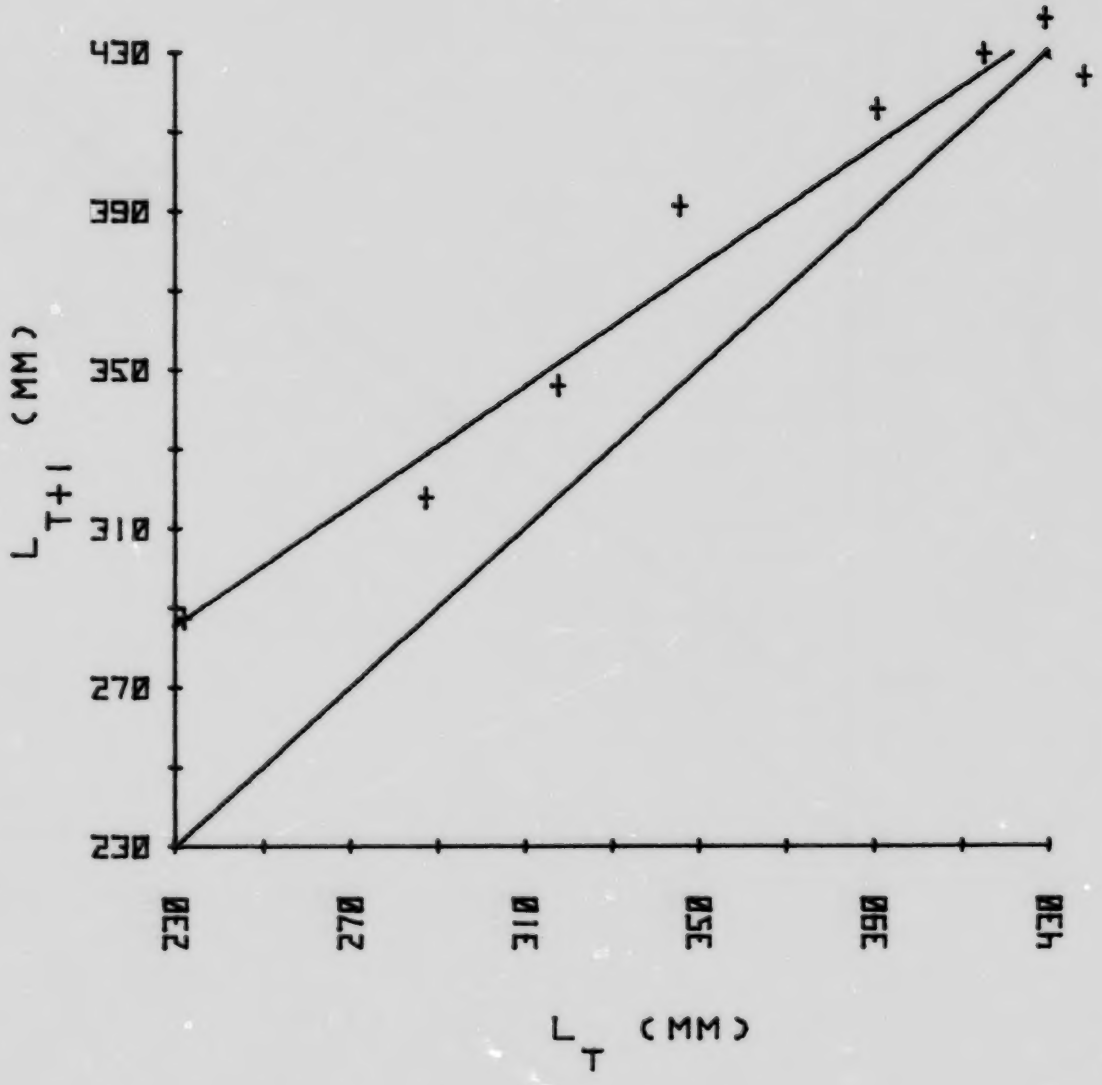

Fig. 19. Walford plot for northern whitefish.

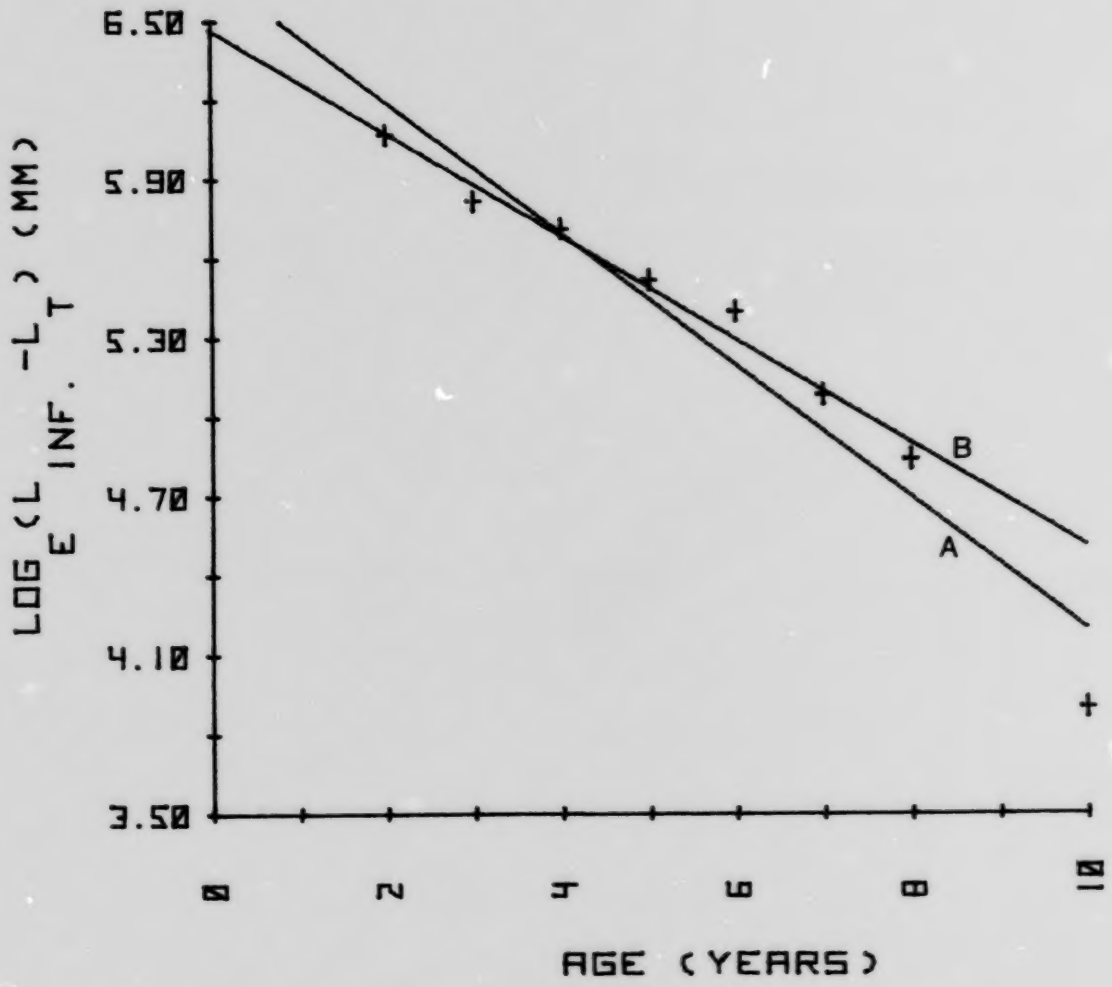

Fig. 20. Plot of $\log_e(L_\infty - \ell_t)$ versus age for southern walleyes. Curve A - all points, Curve B - last point deleted.

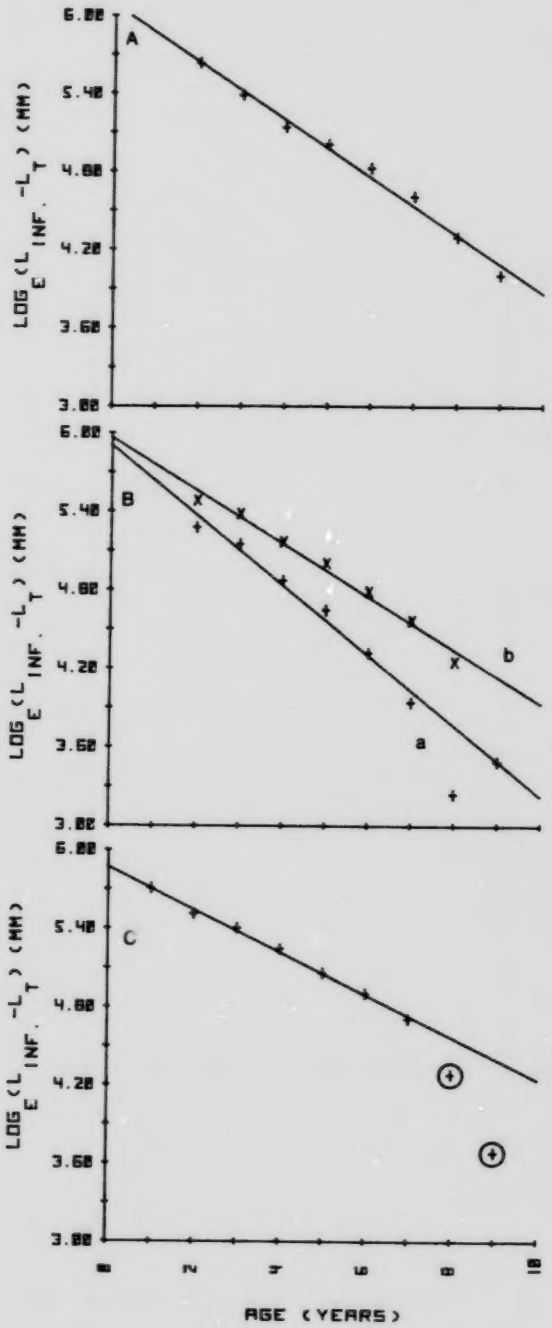

Fig. 21. Plots of $\log_e(L_\infty - \ell_t)$ versus age for northern (A), channel (B) and southern (C) saugers. See table 18 for a description of curves a and b in Fig. B.

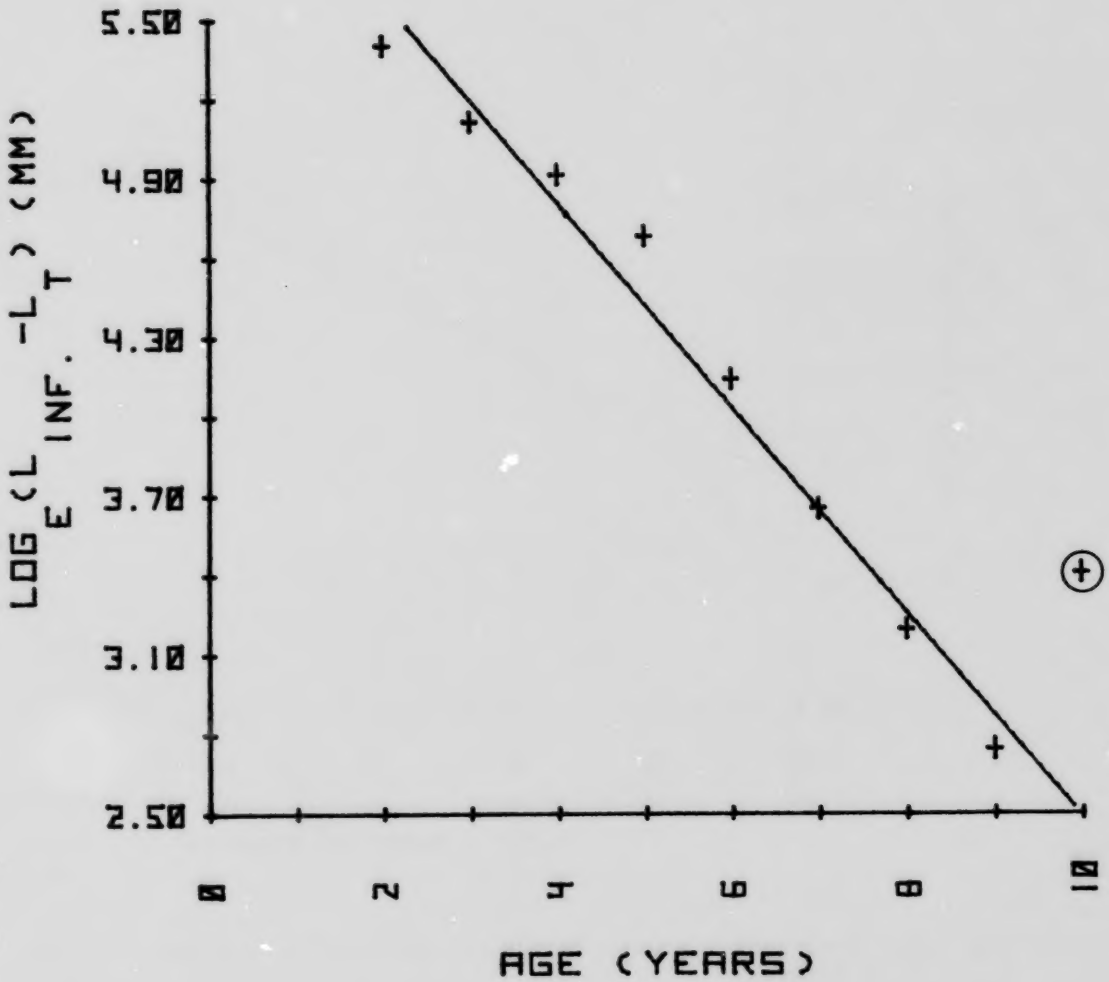

Fig. 22. Plot of $\log_e(L_\infty - \ell_t)$ versus age for whitefish. The outlier was deleted from the analysis.

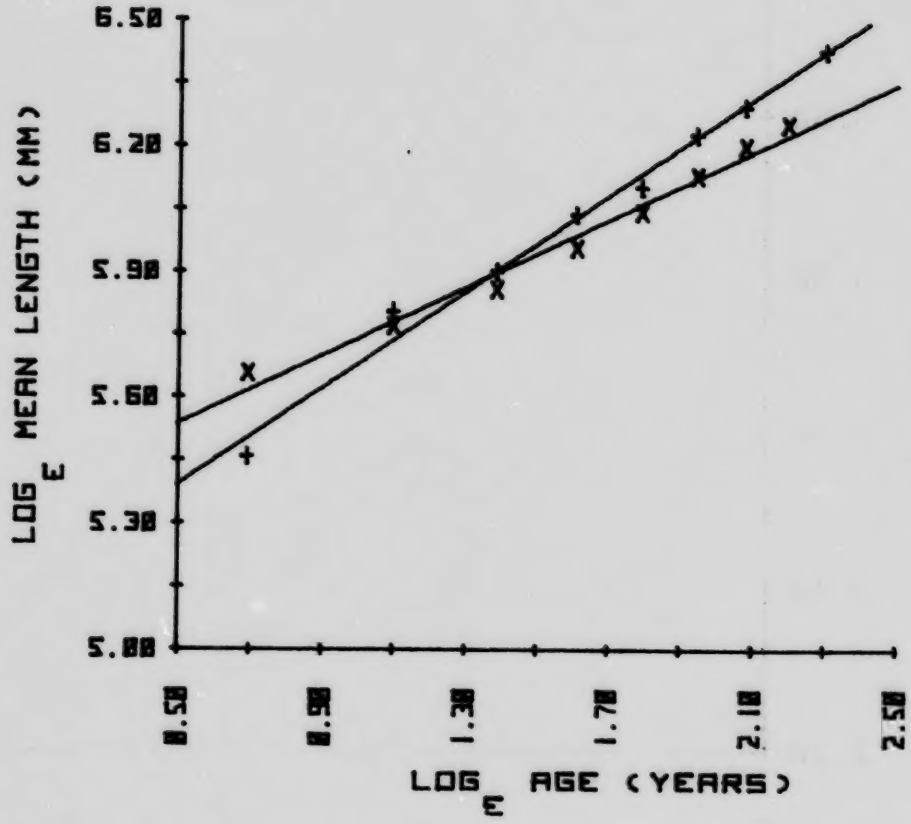

Fig. 23. Exponential growth curves of northern (X) and southern (+) walleyes.

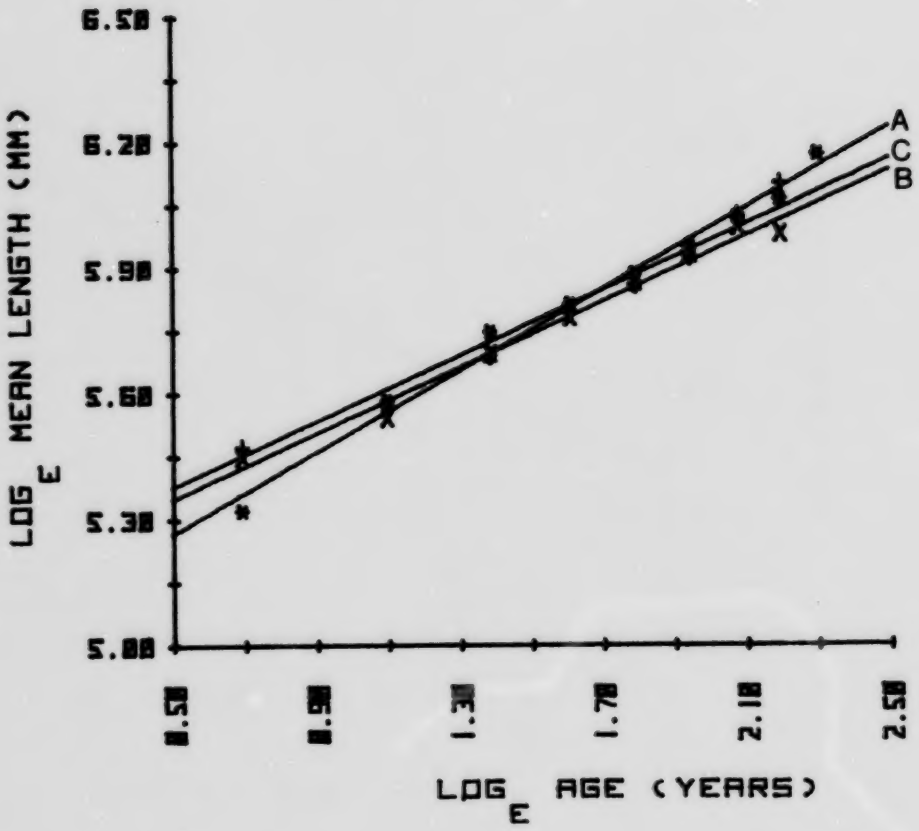

Fig. 24. Exponential growth curves of saugers from the north (A), channel (B) and south (C) of Lake Winnipeg.

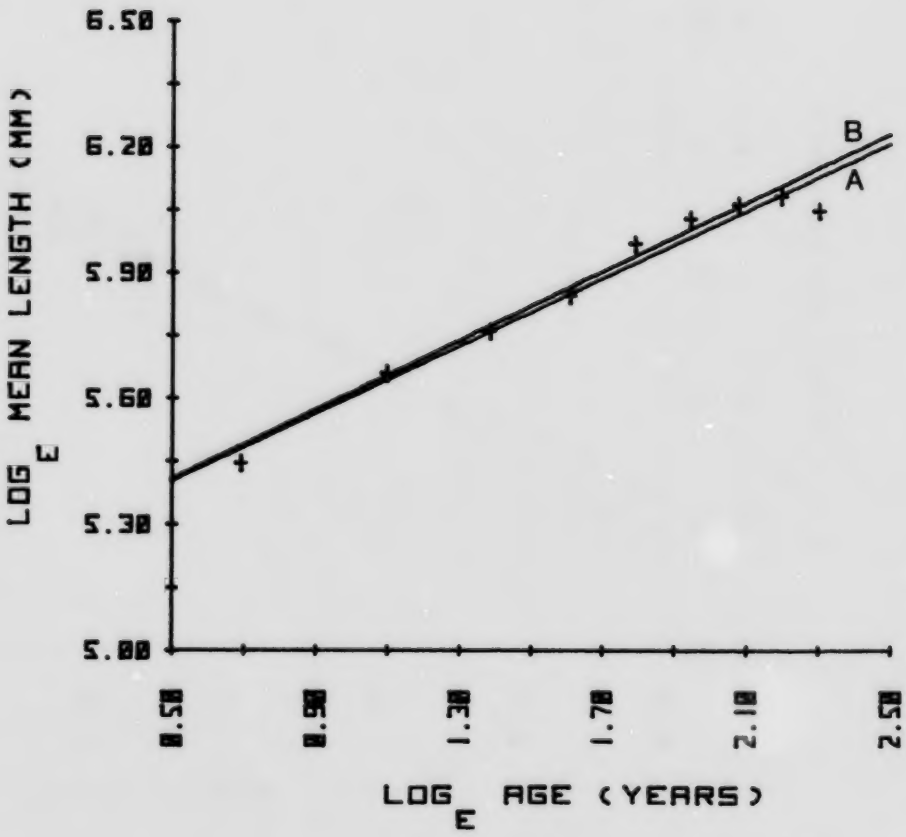

Fig. 25. Exponential growth curves of whitefish. Curve A - all points, Curve b - last point deleted.

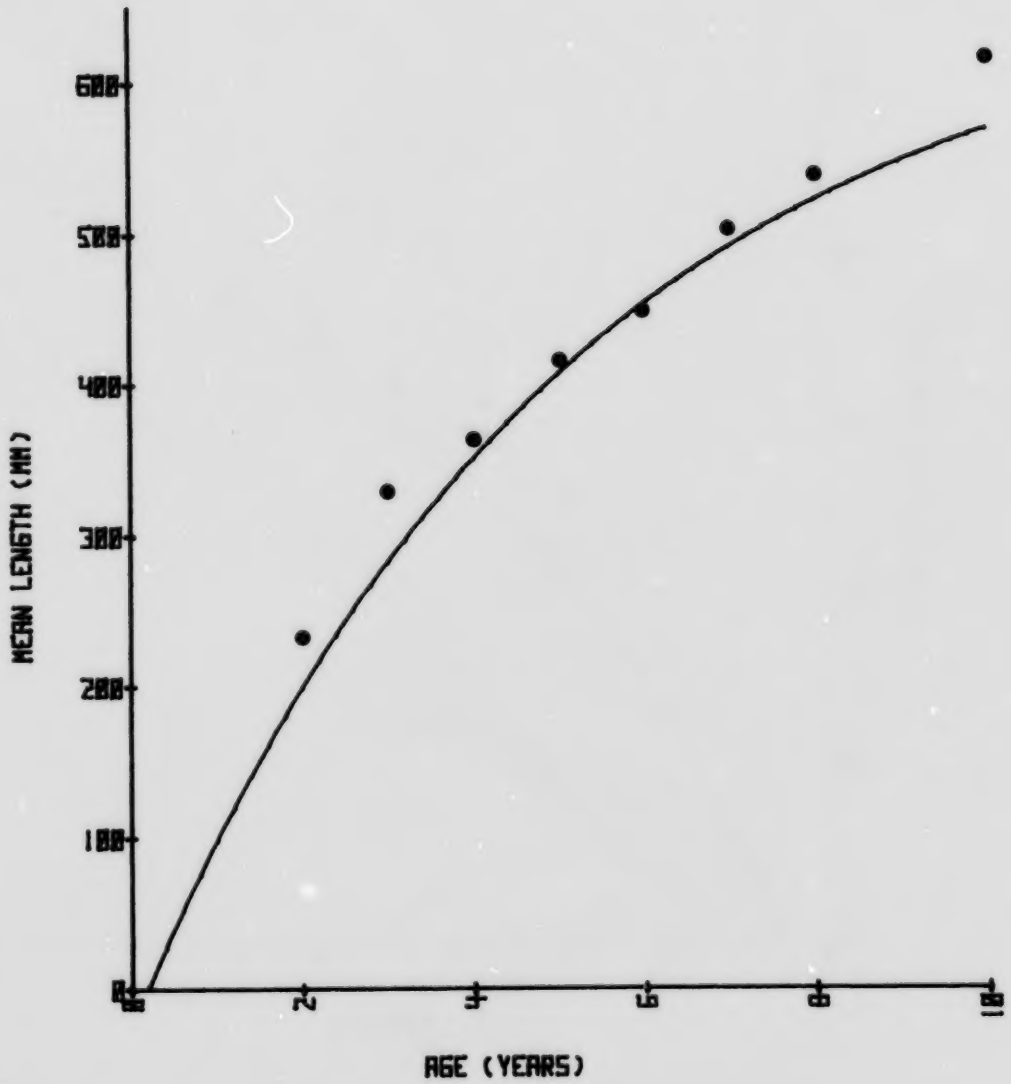

Fig. 26. Von Bertalanffy growth curve of southern walleyes, 1983.

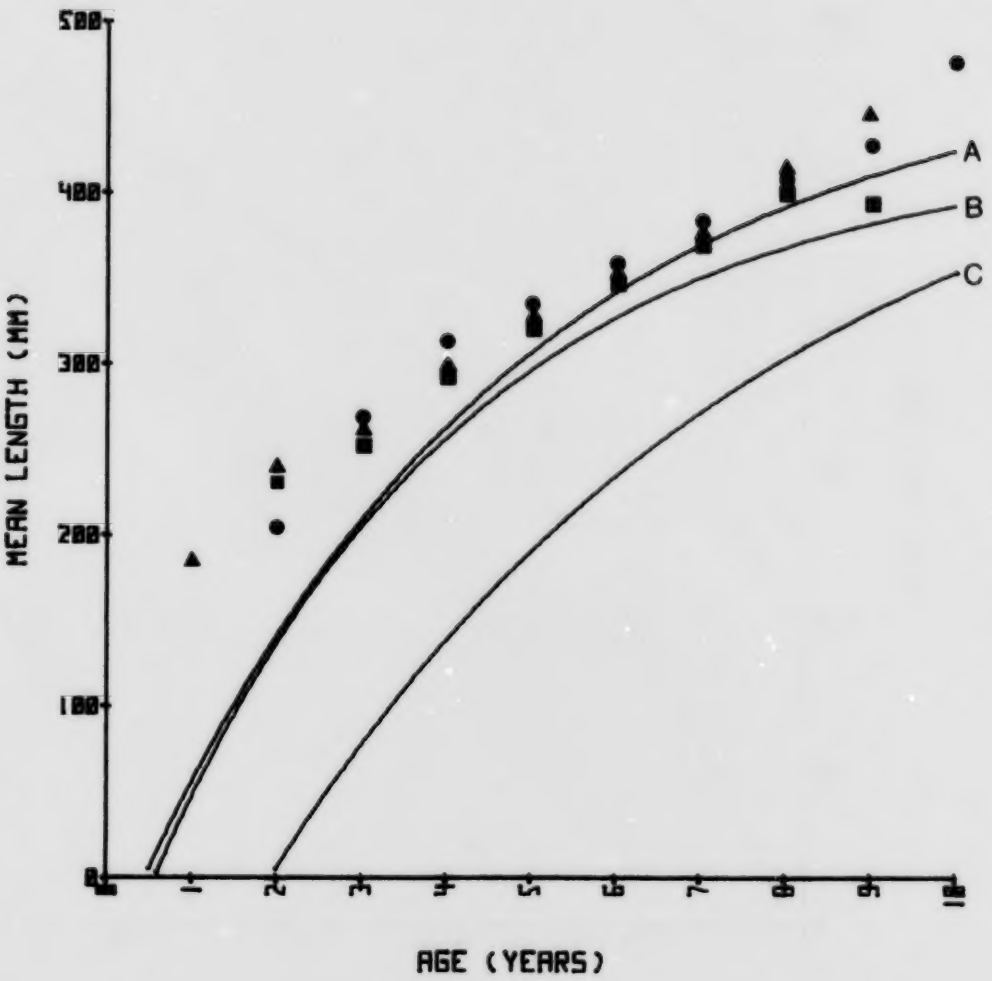

Fig. 27. Von Bertalanffy growth curves of northern (A ●), channel (B■) and southern (C ▲) saugers.

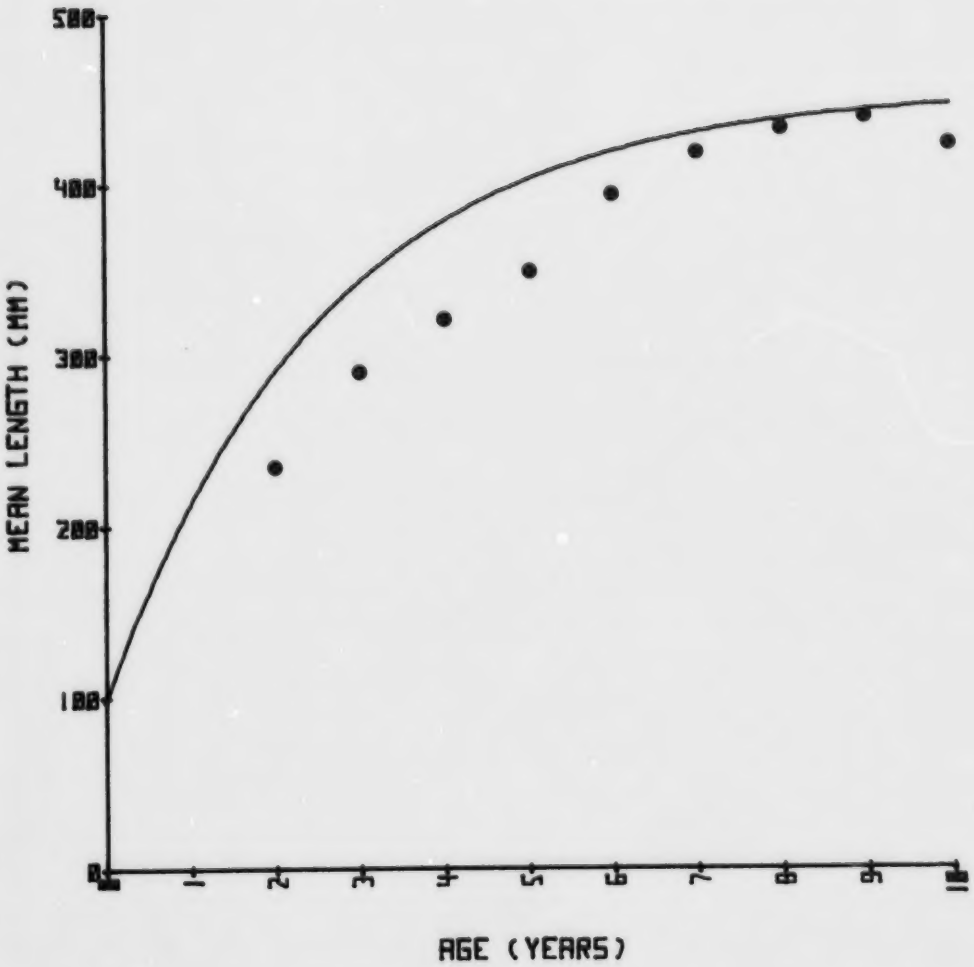

Fig. 28. Von Bertalanffy growth curve of whitefish, 1983.

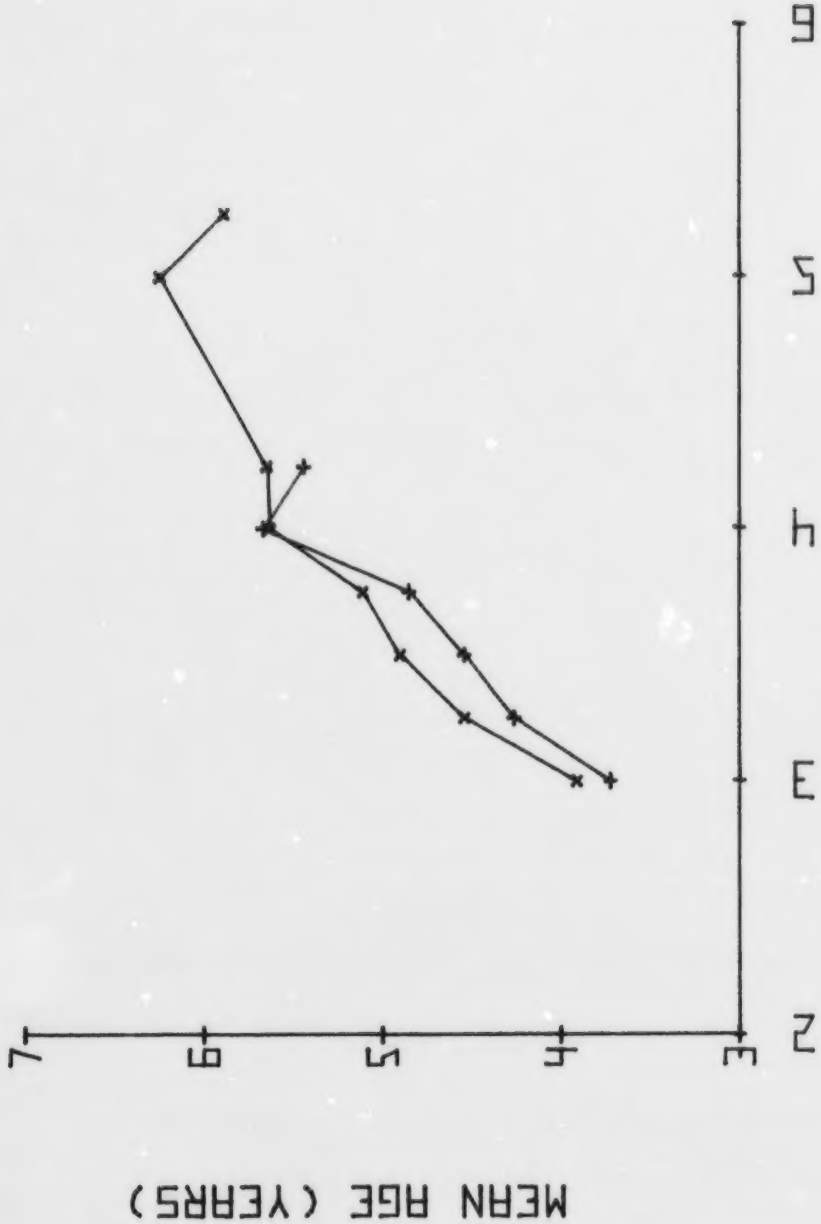

Fig. 29. Effects of mesh size on the mean ages of walleyes caught in northern (x) and southern (+) Lake Winnipeg.

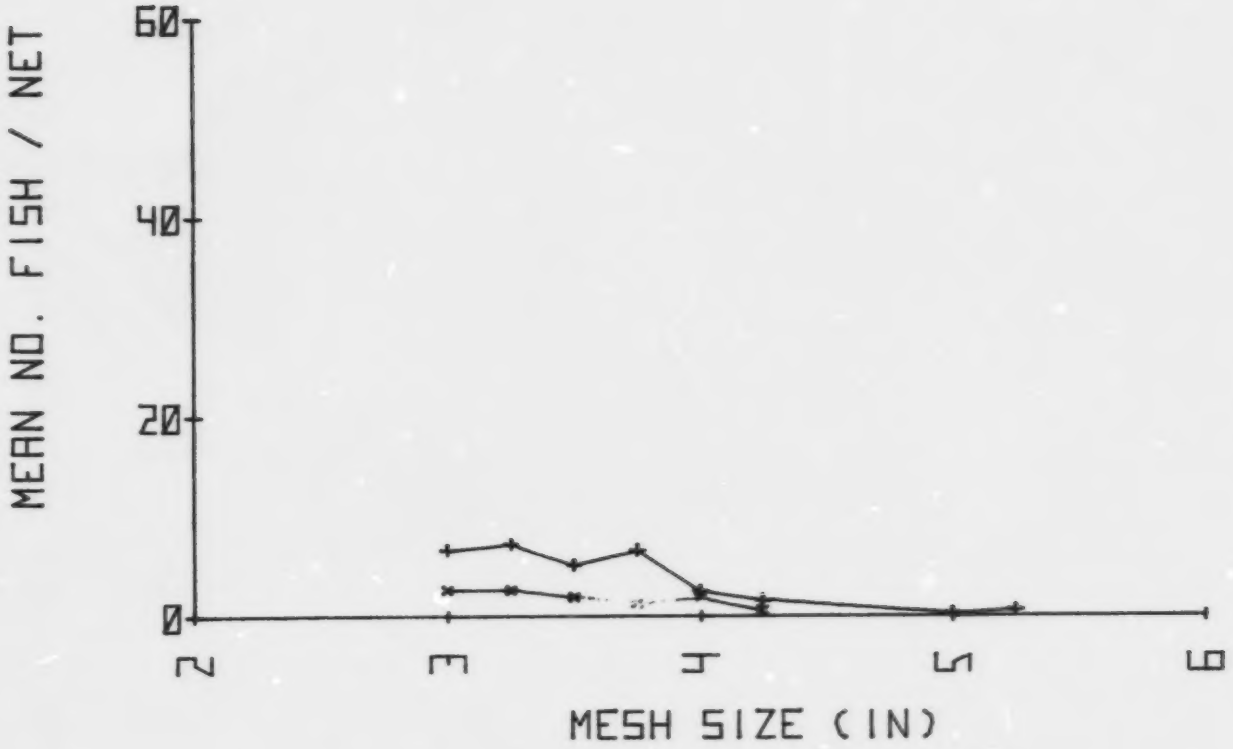

Fig. 30. Effects of mesh size on mean numbers of walleyes per net caught in northern (+) and southern (x) Lake Winnipeg.

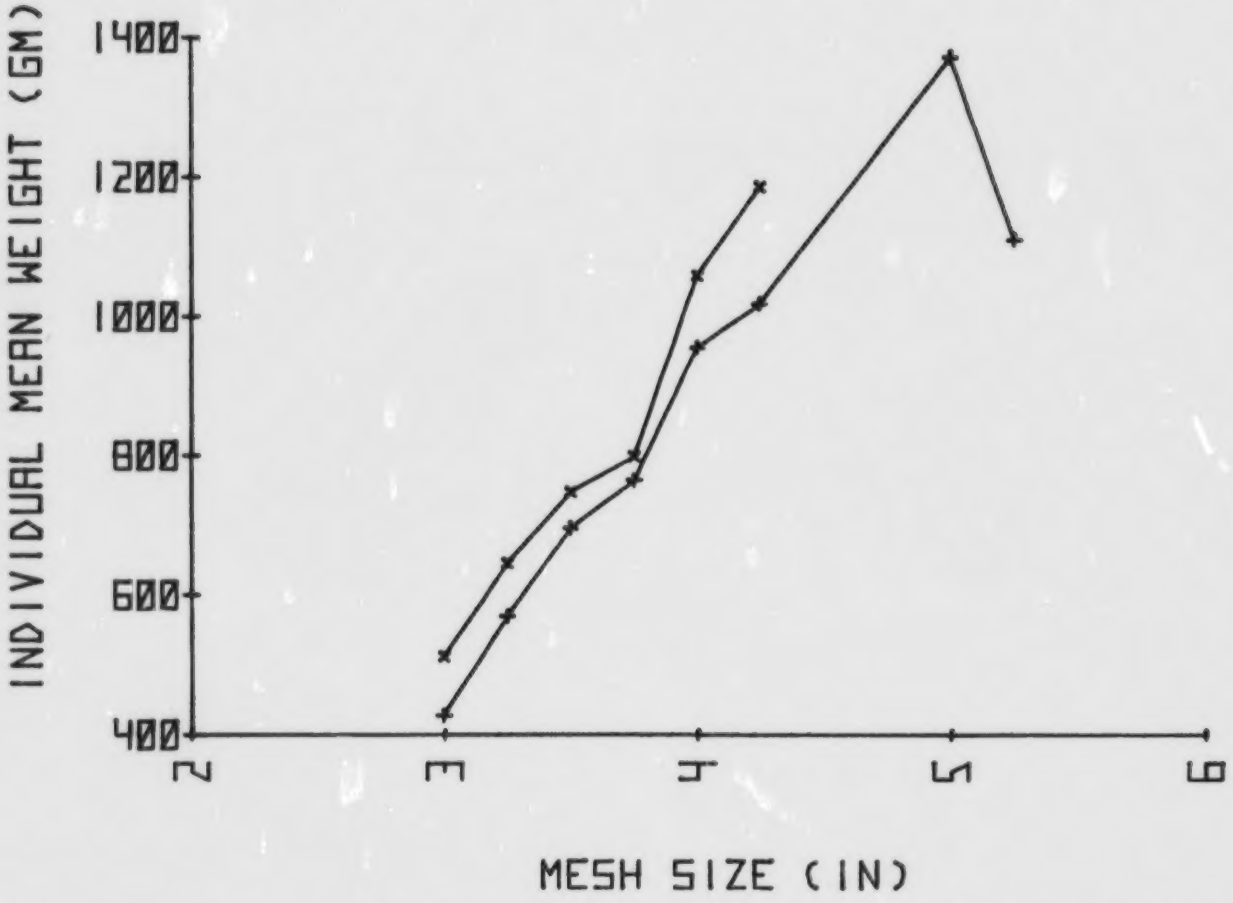

Fig. 31. Effects of mesh size on mean weights of walleyes caught in northern (+) and southern (x) Lake Winnipeg.

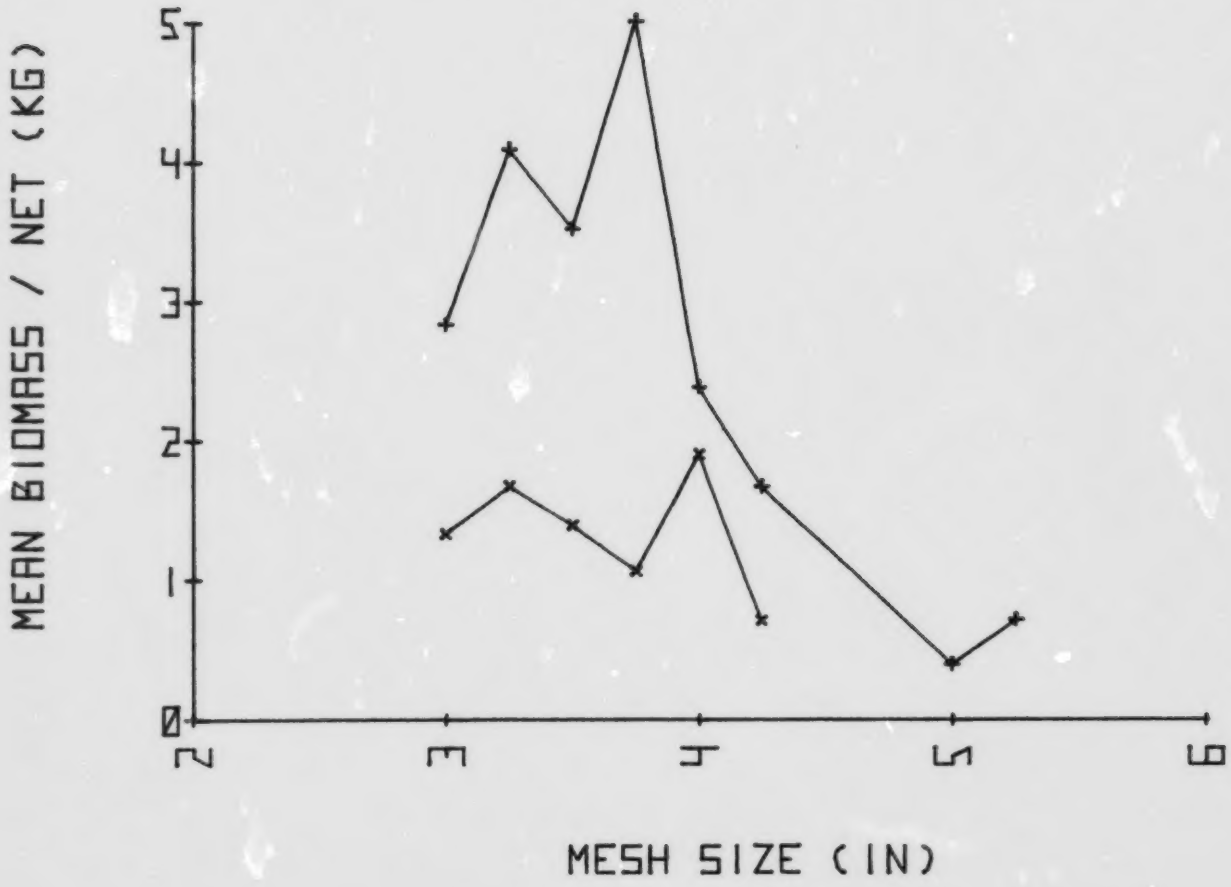

Fig. 32. Effects of mesh size on the mean biomass per net of walleyes in northern (+) and southern (x) Lake Winnipeg.

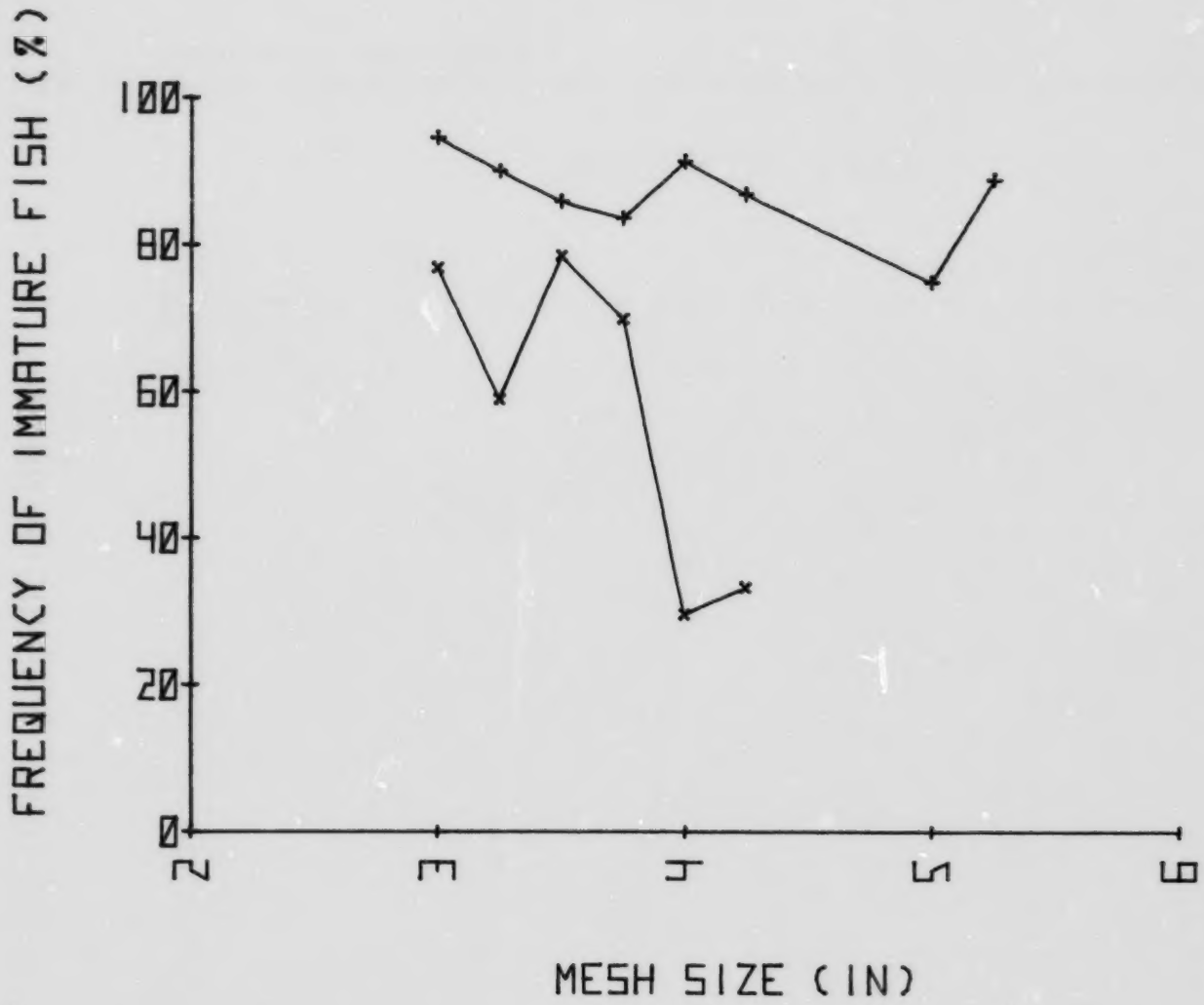

Fig. 33. Effects of mesh size on frequencies of immature walleyes caught in northern (+) and southern (x) Lake Winnipeg.

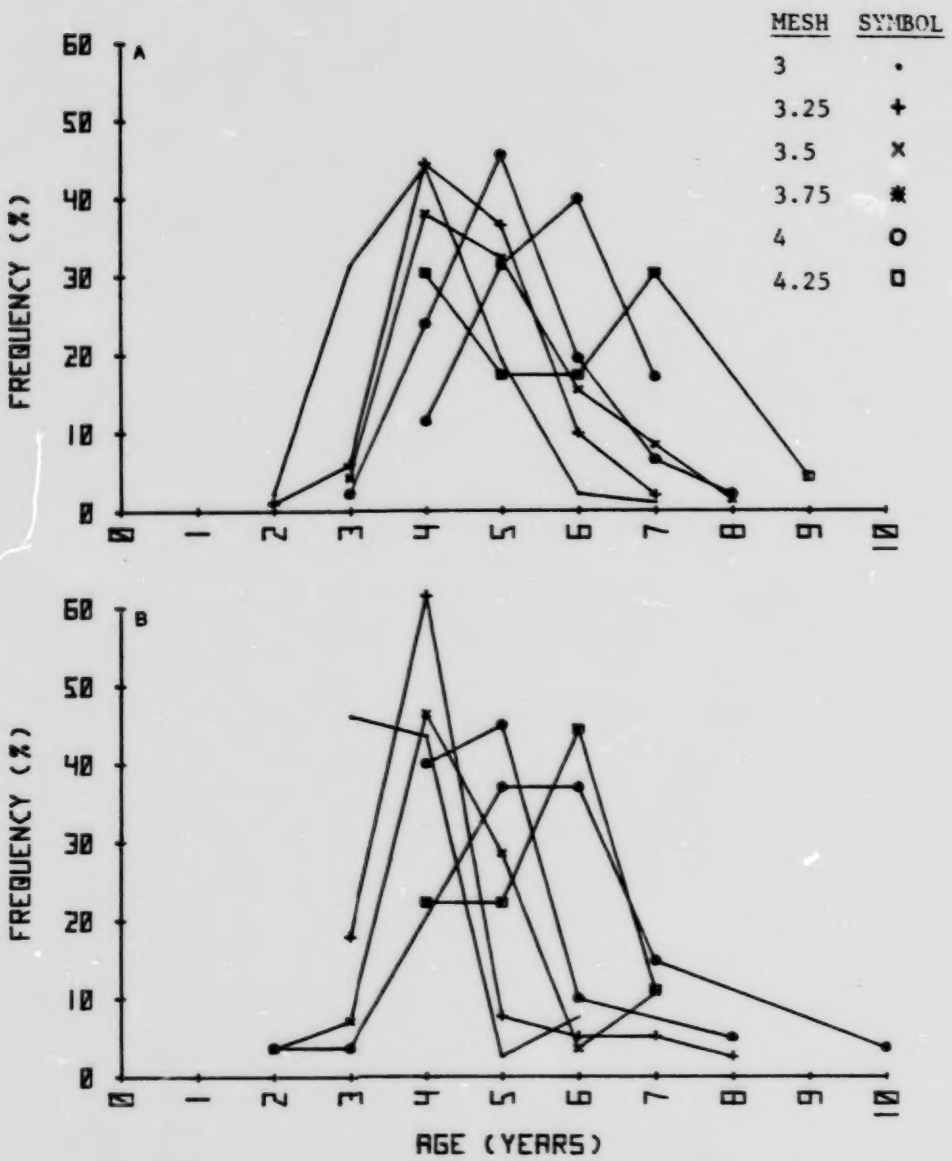

Fig. 34. Effects of mesh size on age frequency distributions of northern (A) and southern (B) walleyes.

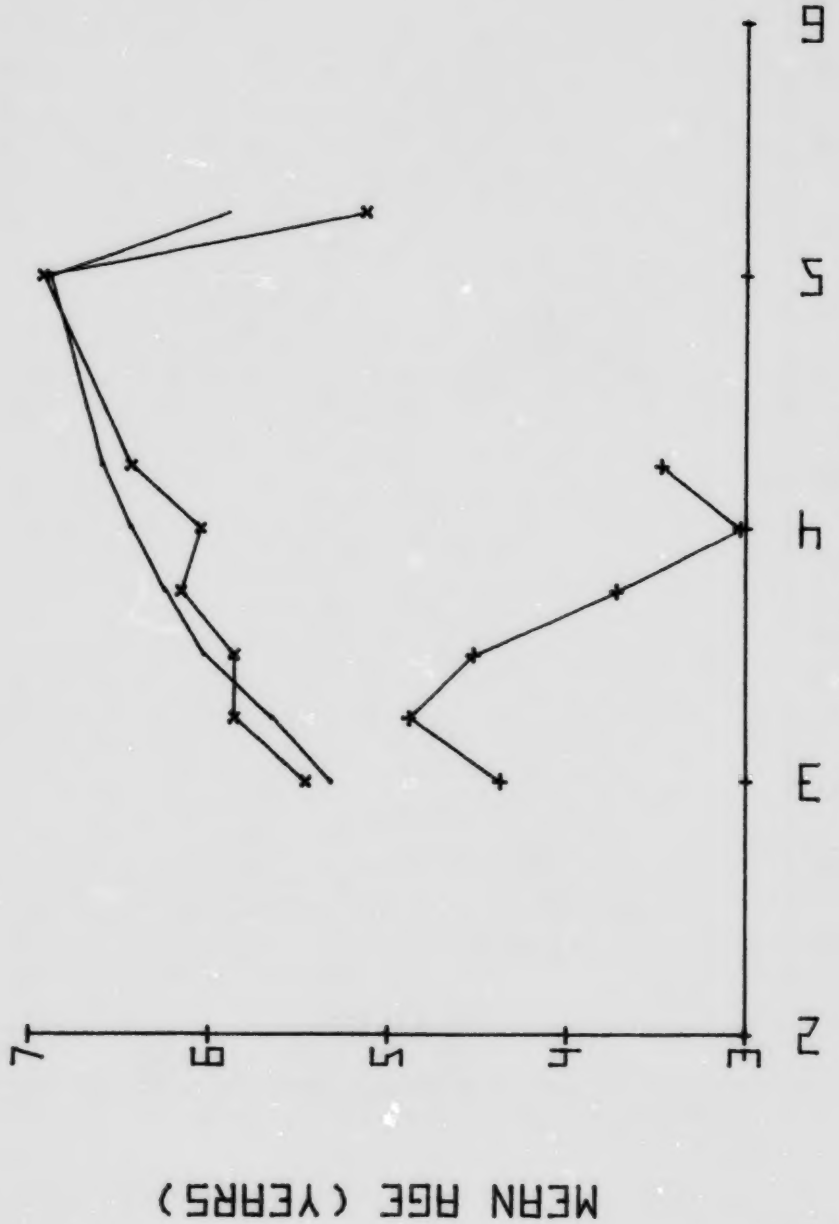

Fig. 35. The effects of mesh size on mean ages of saugers caught in the northern (·), channel (x) and southern (+) areas of Lake Winnipeg.

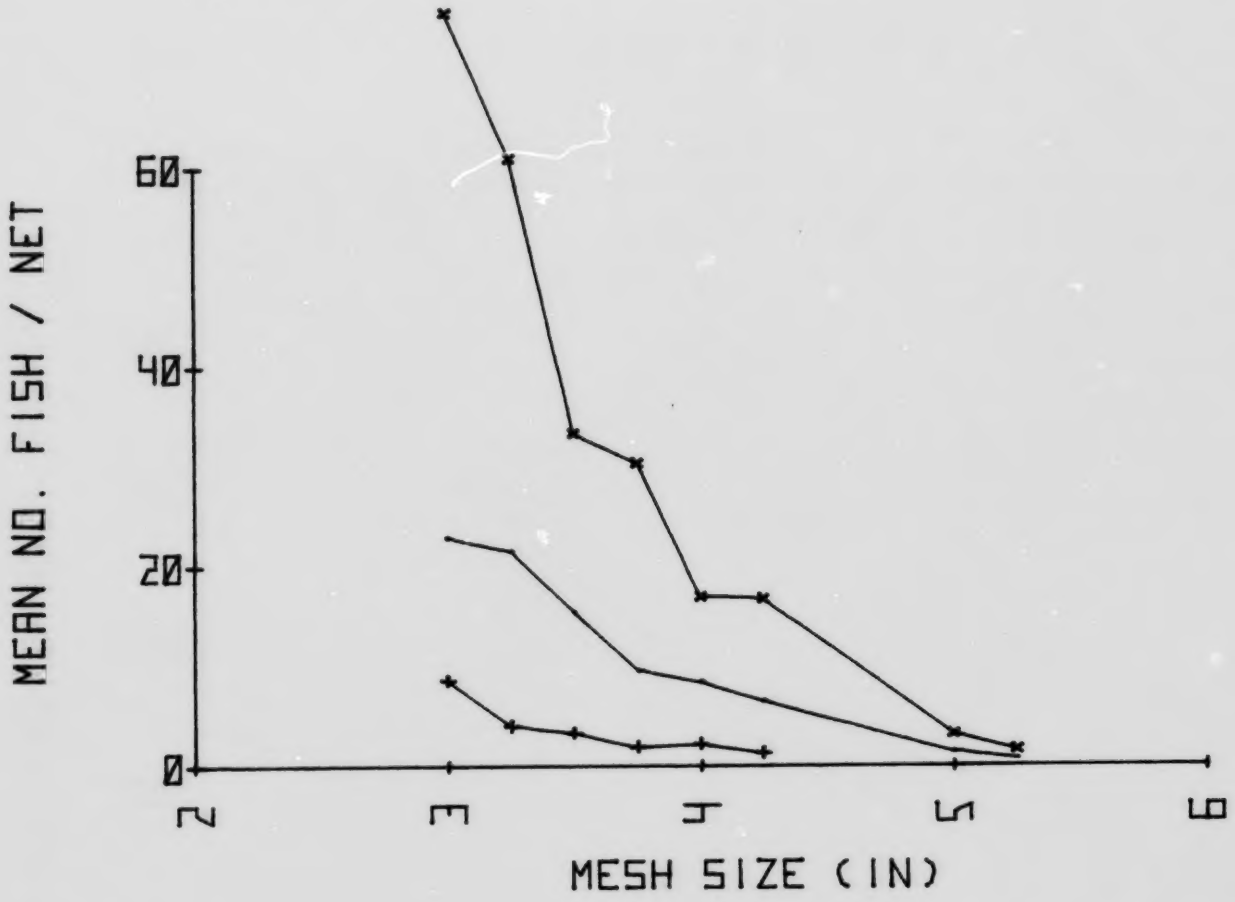

Fig. 36. Effects of mesh size on mean numbers of saugers per net caught in the north basin (·), channel (x) and south basin (+) of Lake Winnipeg.

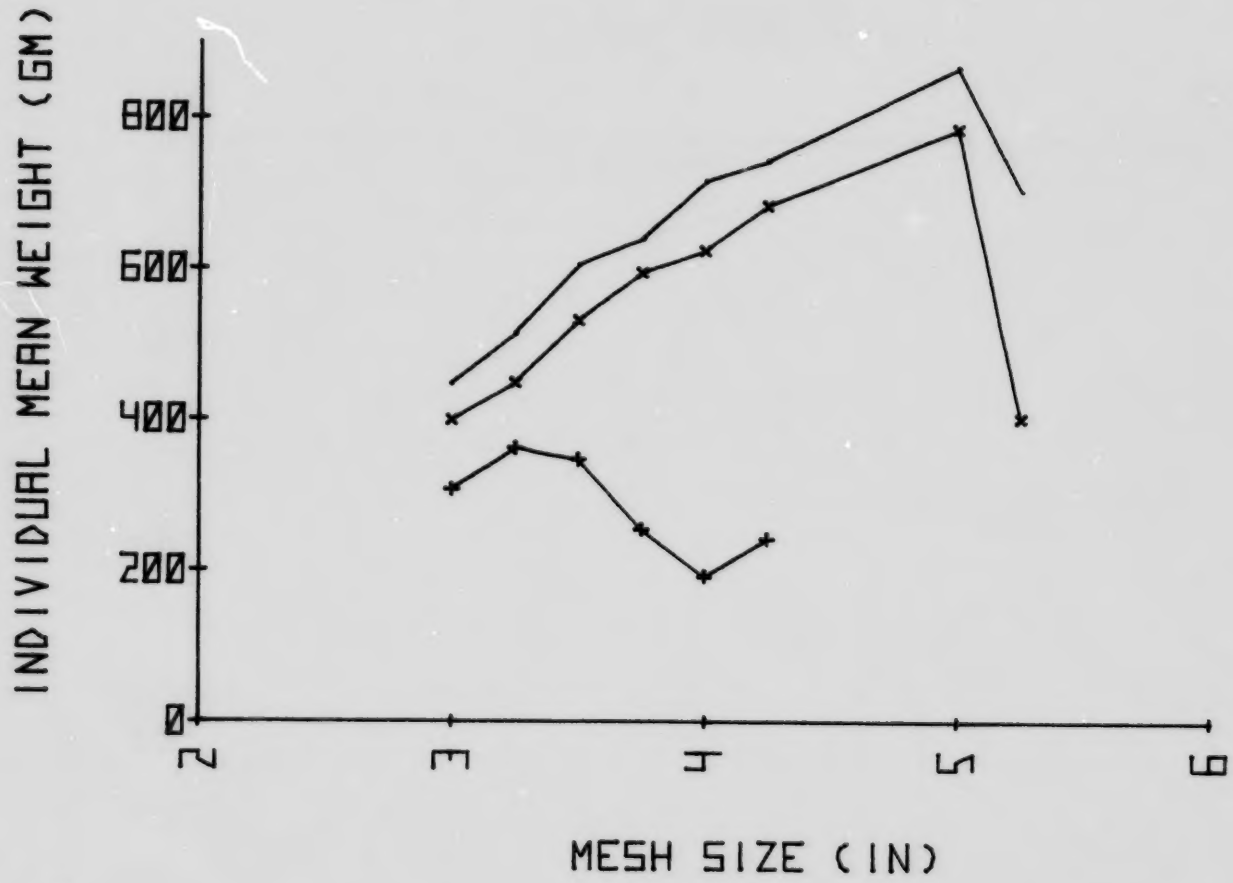

Fig. 37. Effects of mesh size on mean weights of saugers caught in the northern (·), channel (x) and southern (+) areas of Lake Winnipeg.

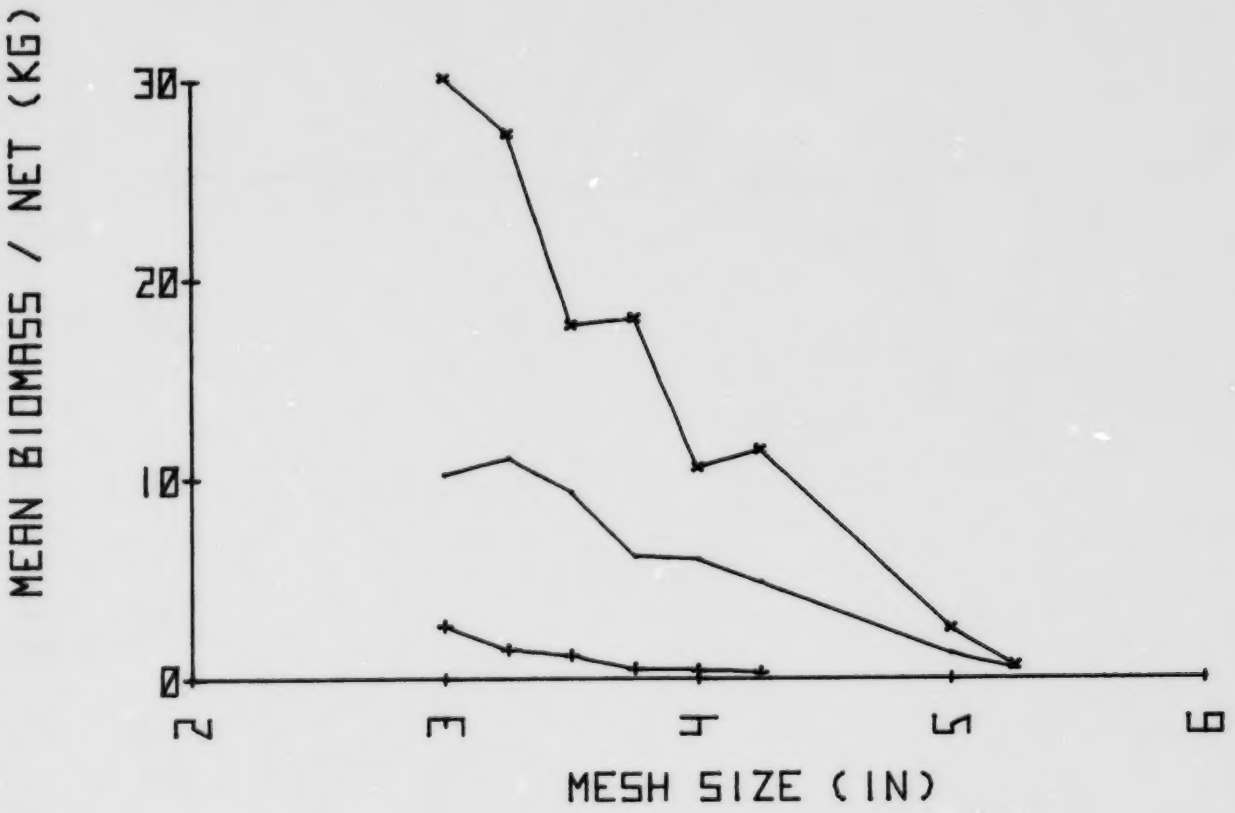

Fig. 38. Effects of mesh size on the mean biomass per net of saugers caught in the northern (·) channel (x) and southern (+) areas of Lake Winnipeg.

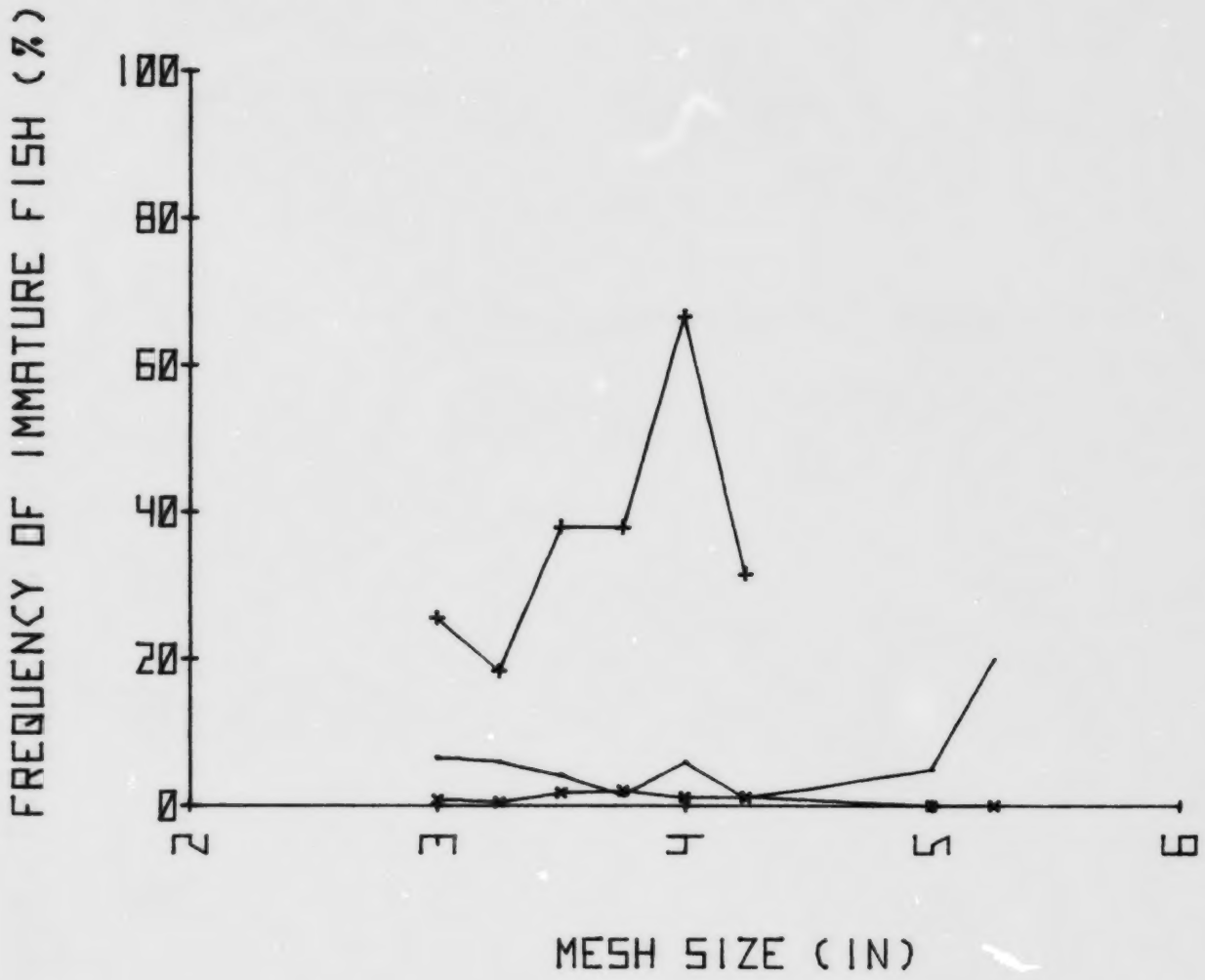

Fig. 39. Effects of mesh size on frequencies of immature saugers caught in the northern (·), channel (x) and southern (+) areas of Lake Winnipeg.

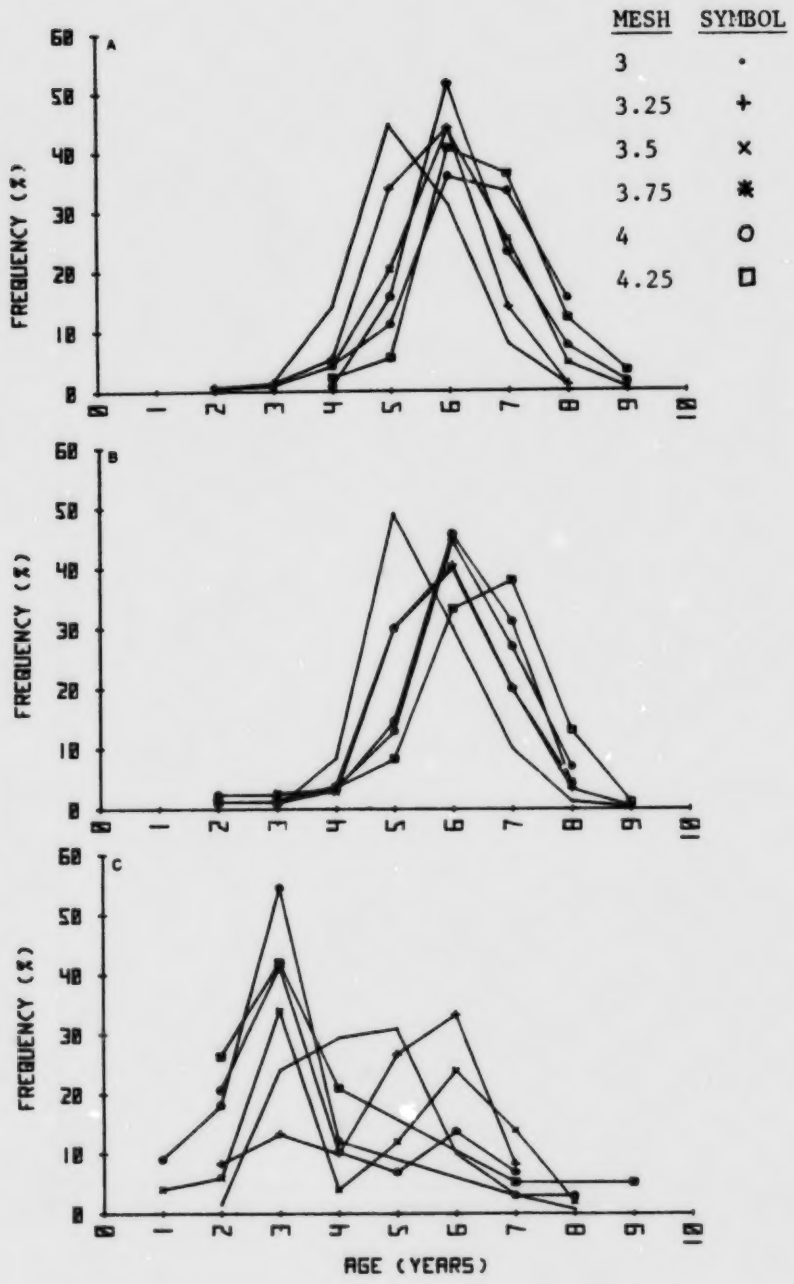

Fig. 40. Effects of mesh size on age frequency distributions of northern (A), channel (B) and southern (C) saugers.

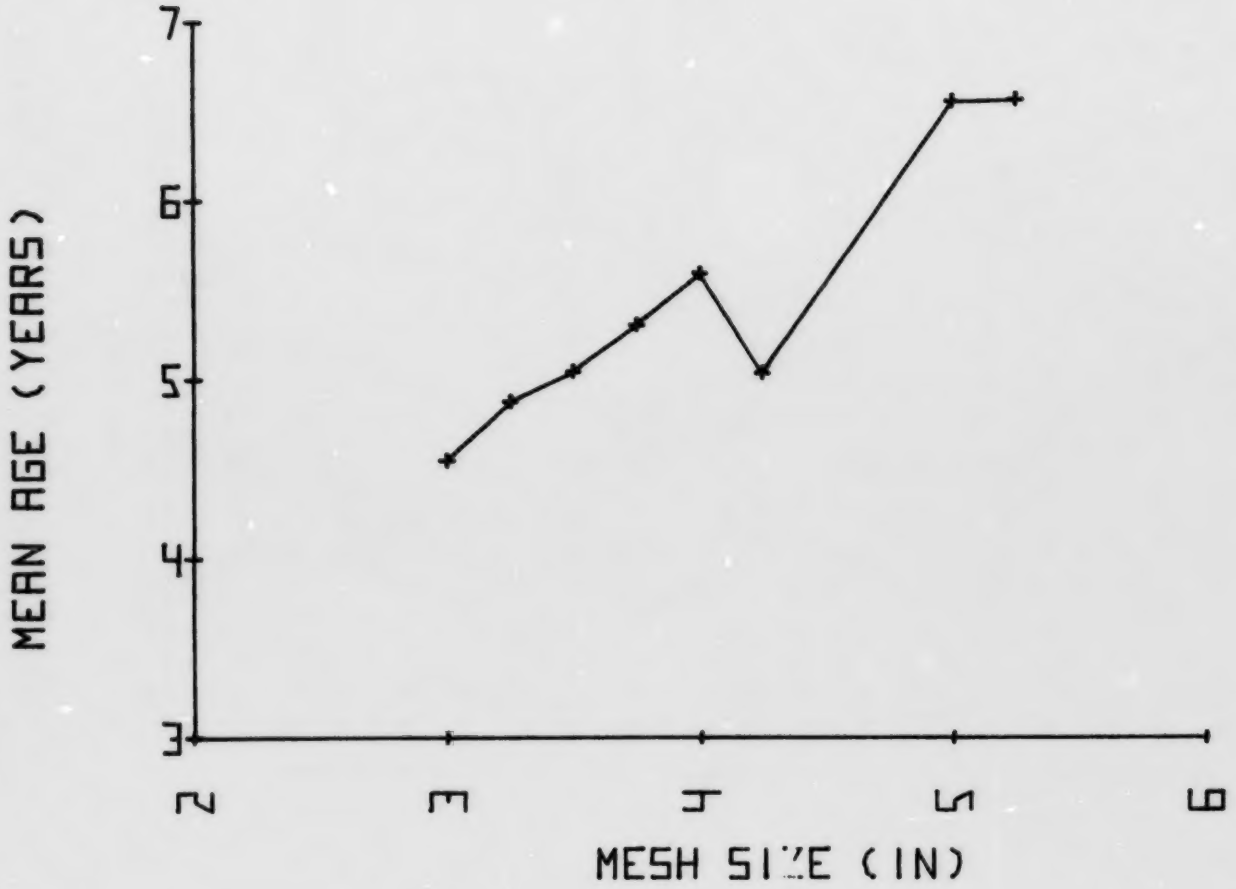

Fig. 41. The relationship of mean age of whitefish and mesh sizes in the north basin of Lake Winnipeg.

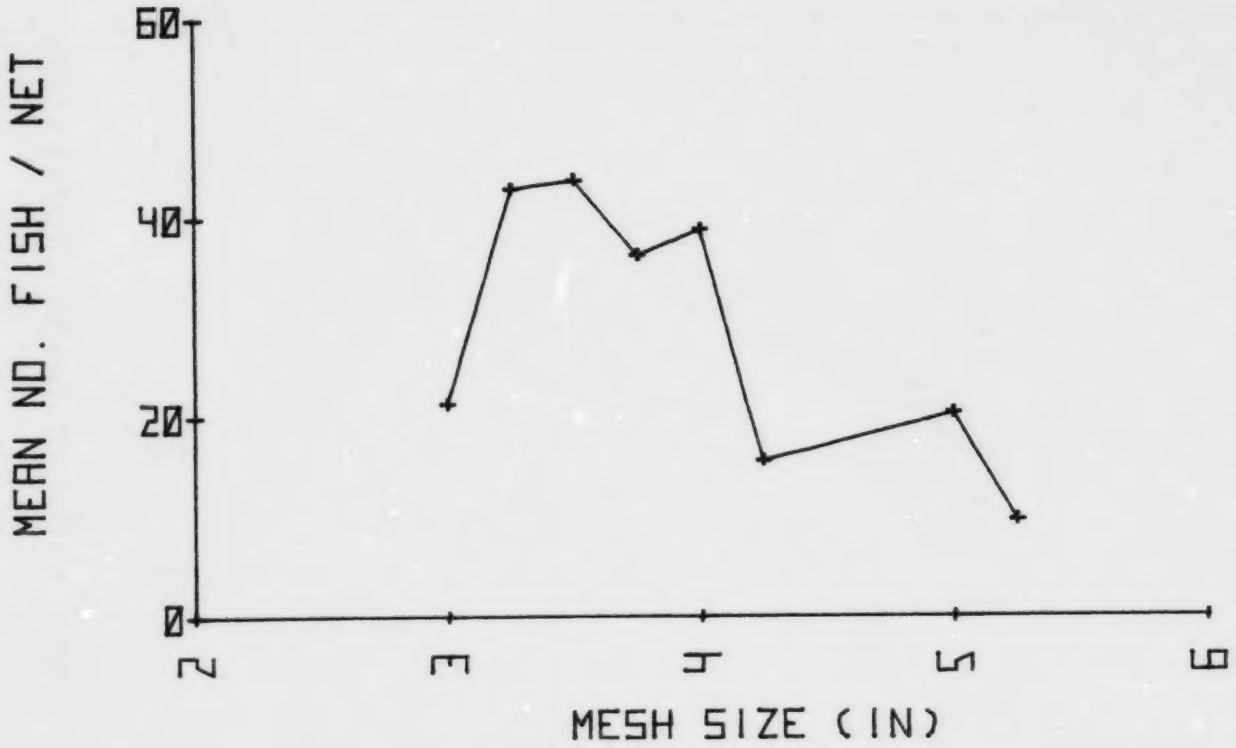

Fig. 42. Effect of mesh size on mean numbers of whitefish per net caught in northern Lake Winnipeg.

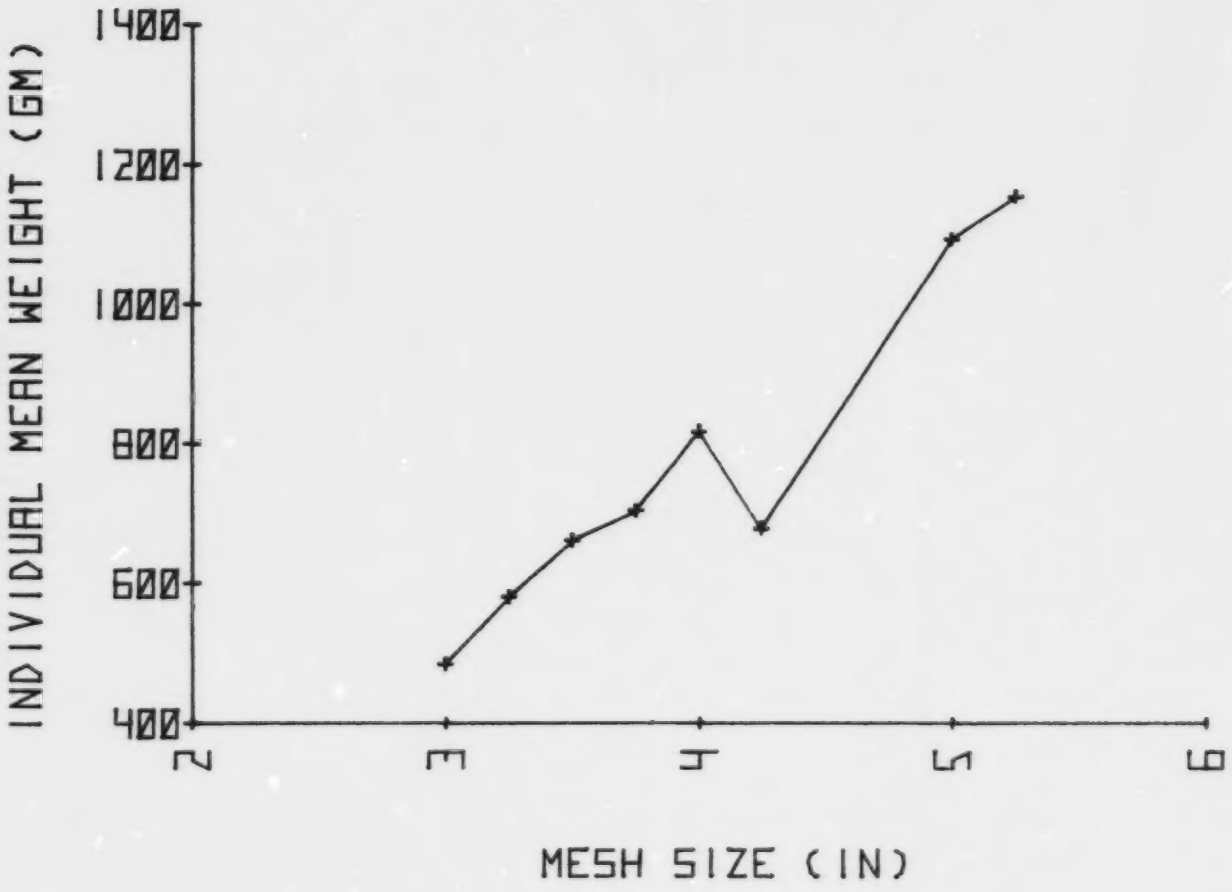

Fig. 43. Effects of mesh size on mean weight of northern whitefish.

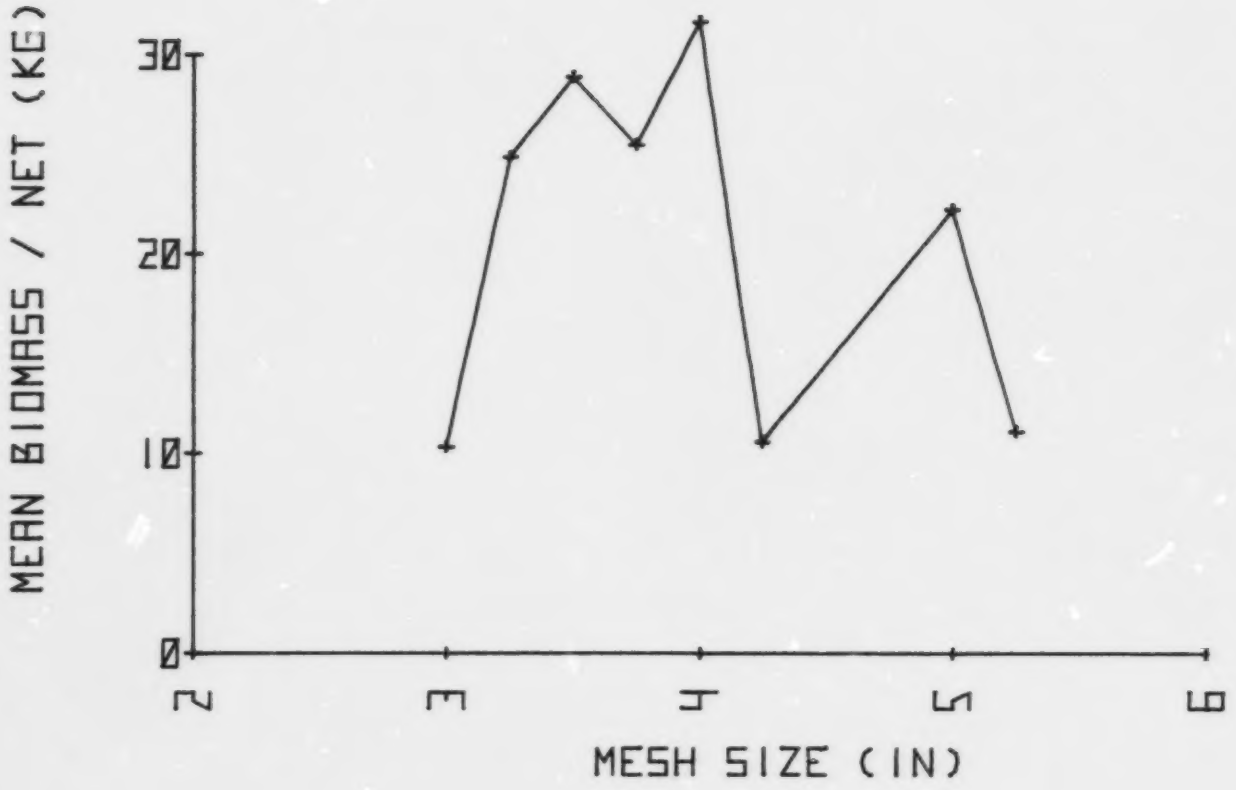

Fig. 44. Effects of mesh size on the mean biomass per net of whitefish caught in northern Lake Winnipeg.

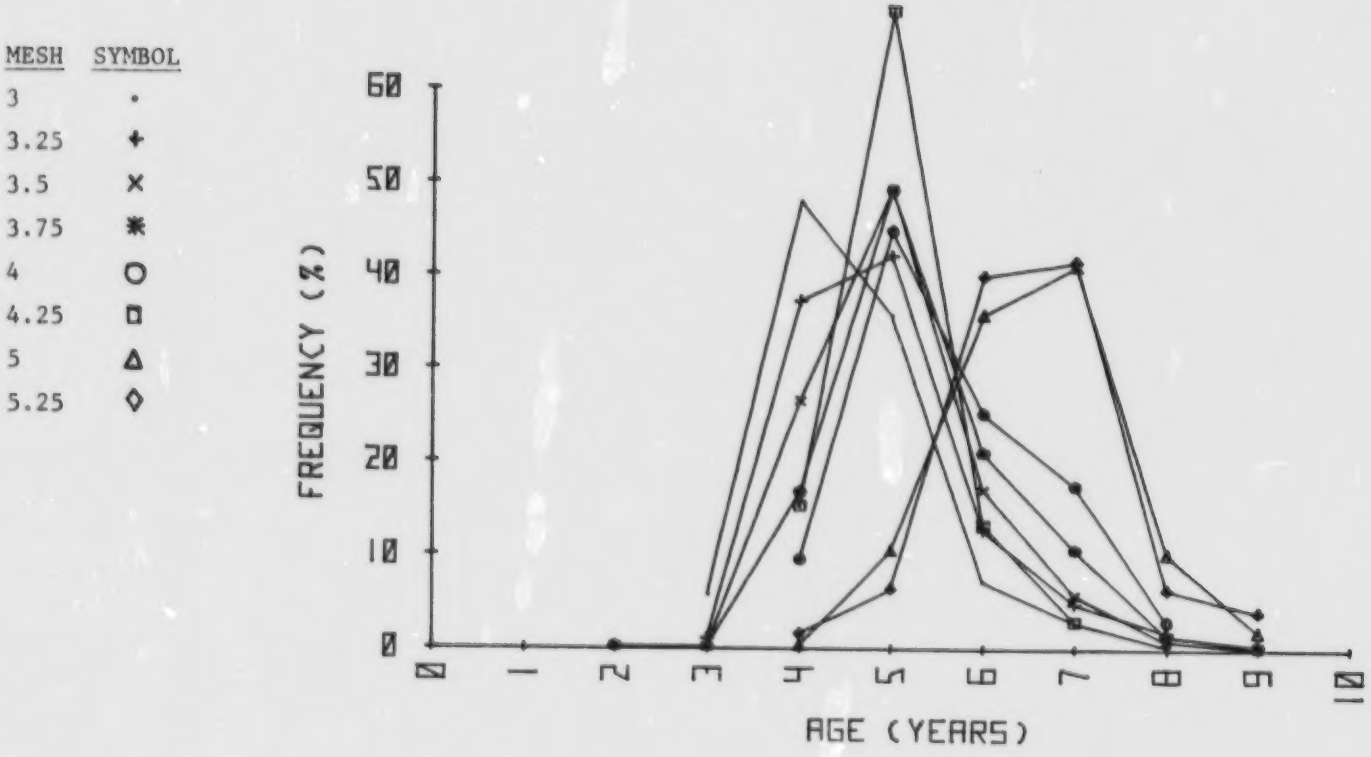

Fig. 45. Effects of mesh size on age frequency distribution of northern whitefish.

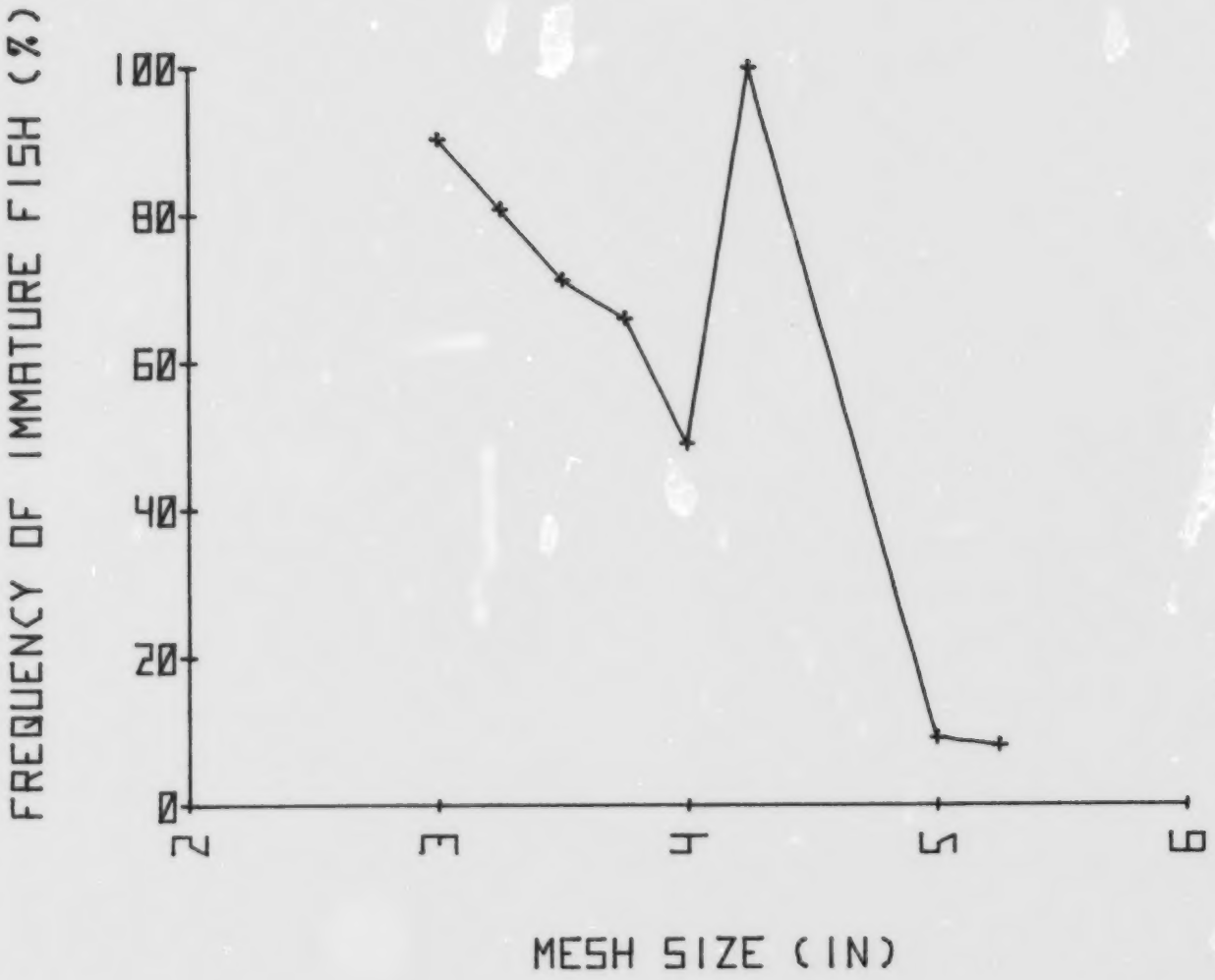

Fig. 46. Effect of mesh size on the frequency of immature whitefish caught in northern Lake Winnipeg.

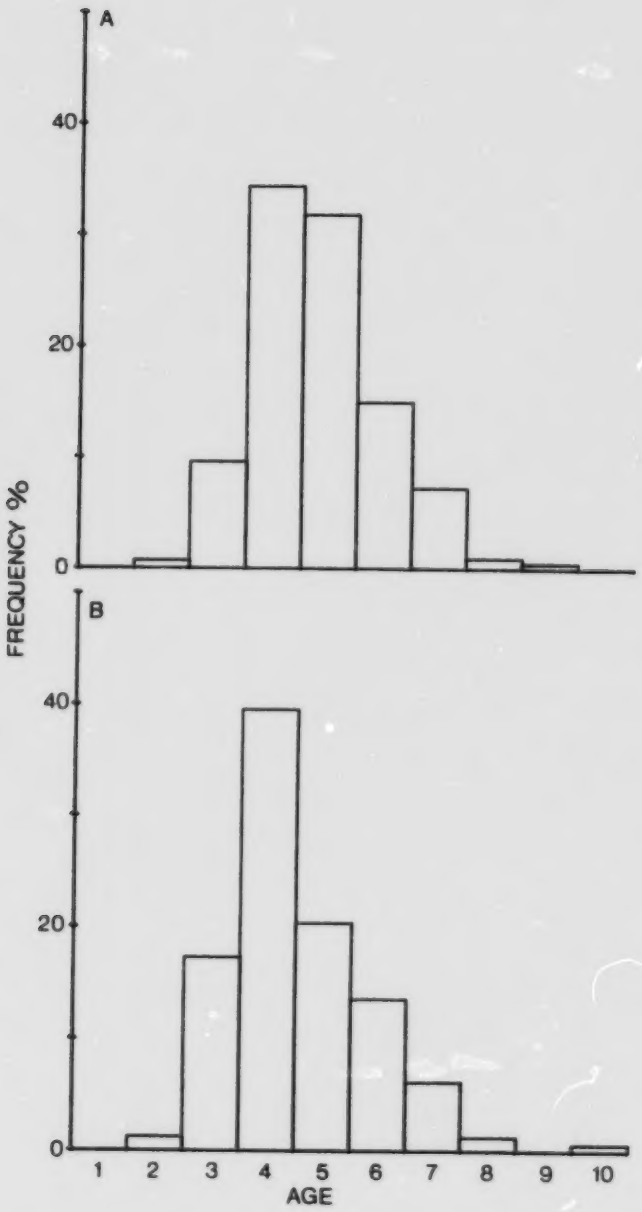

Fig. 47. Age compositions of experimentally caught walleyes from the northern (A) and southern (B) basins of Lake Winnipeg, 1983.

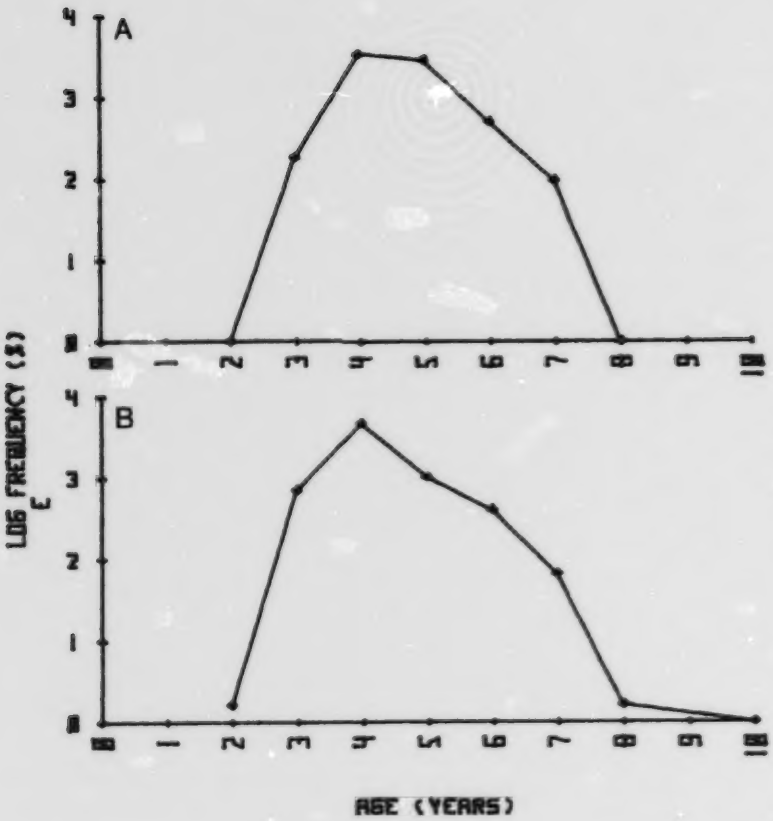

Fig. 48. Catch curves of experimentally caught walleyes from Northern (A) and southern (B) Lake Winnipeg, 1983.

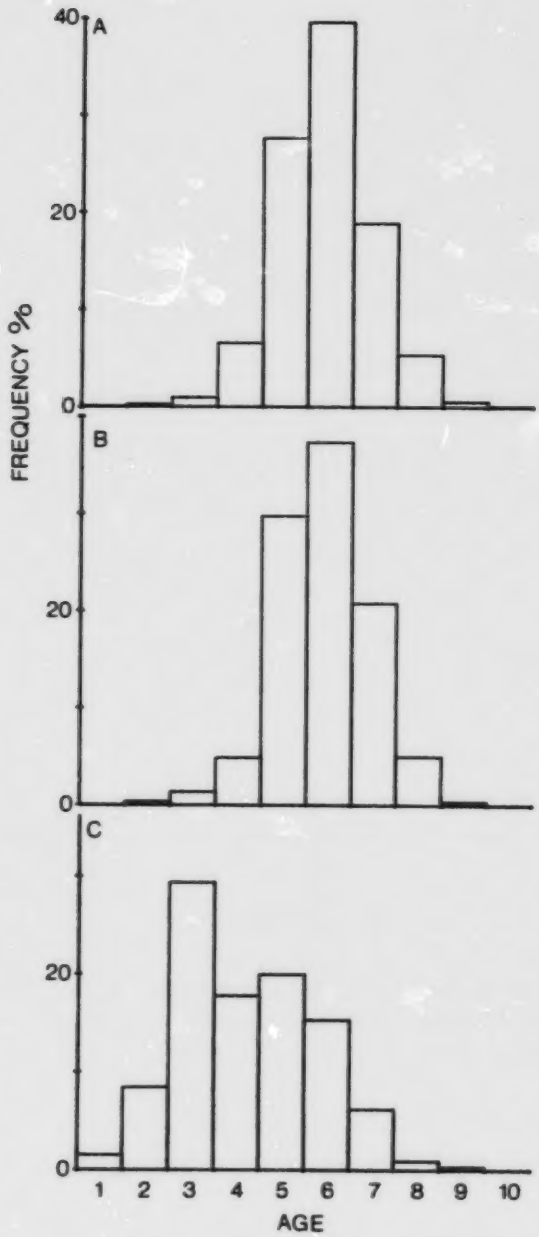

Fig. 49. Age compositions of experimentally caught saugers from the north (A), channel (B) and south (C) basins of Lake Winnipeg, 1983.

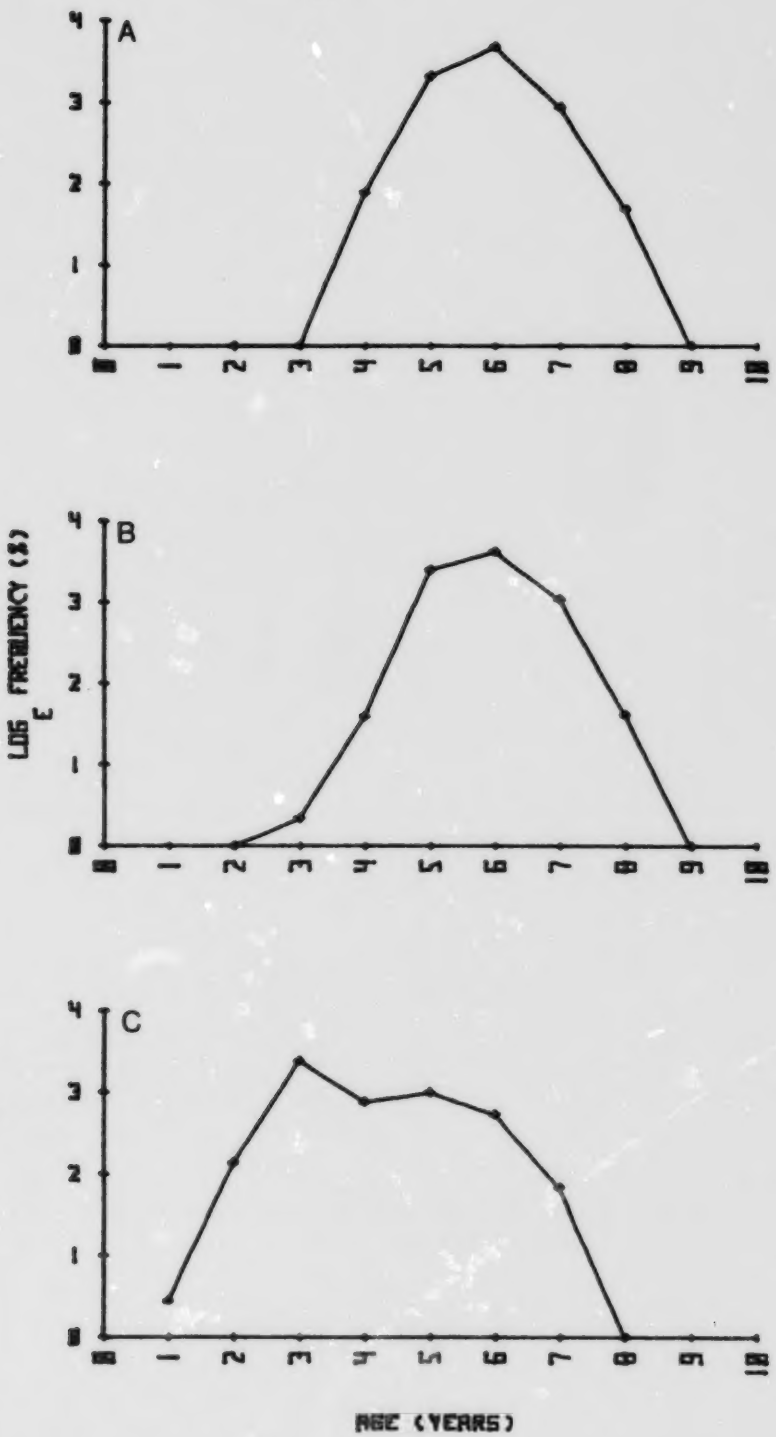

Fig. 50. Catch curves of experimentally caught saugers from the northern (A), channel (B) and southern (C) areas of Lake Winnipeg, 1983.

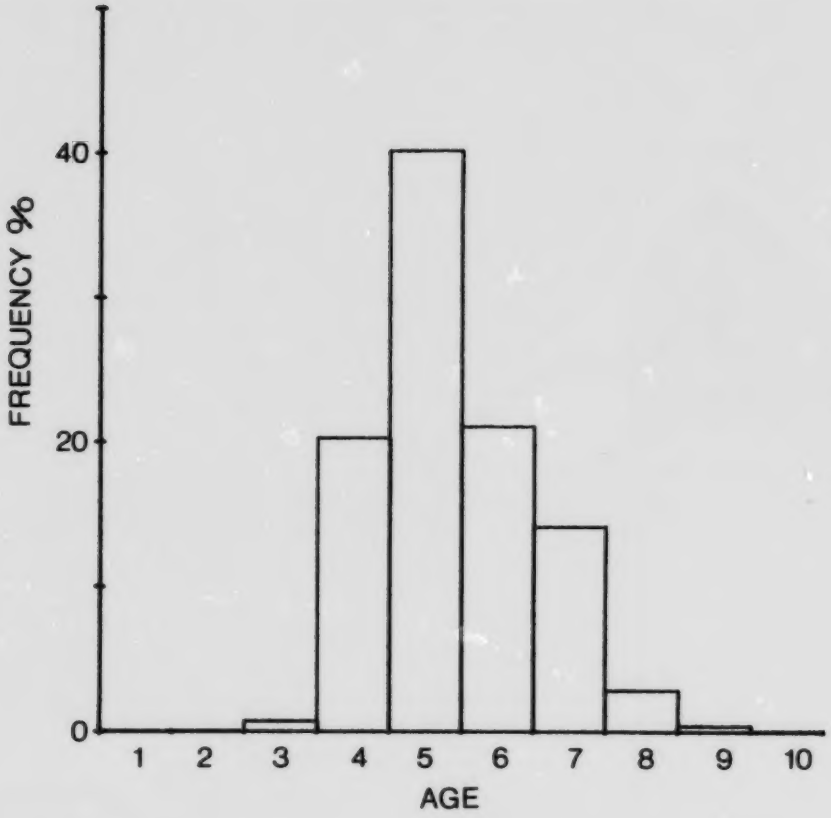

Fig. 51. Age composition of whitefish from northern Lake Winnipeg, 1983.

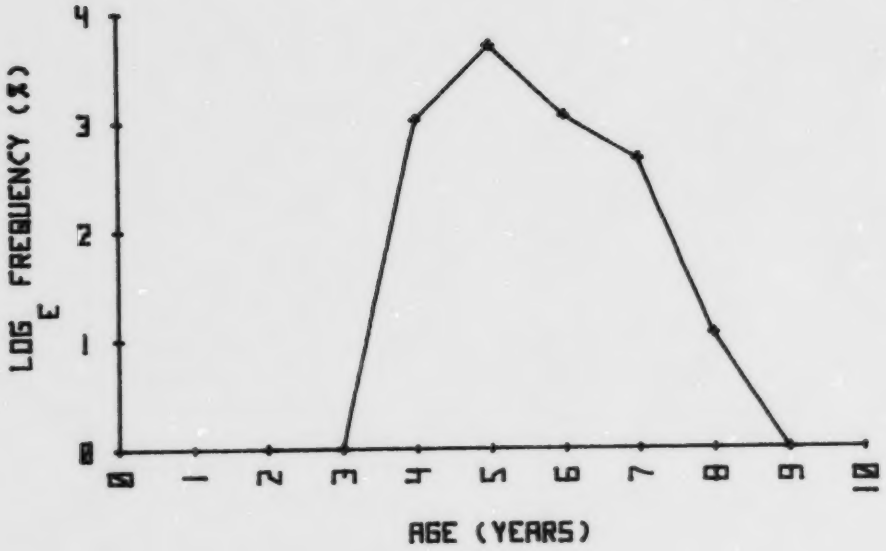

Fig. 52. Catch curve of experimentally caught whitefish, 1983.

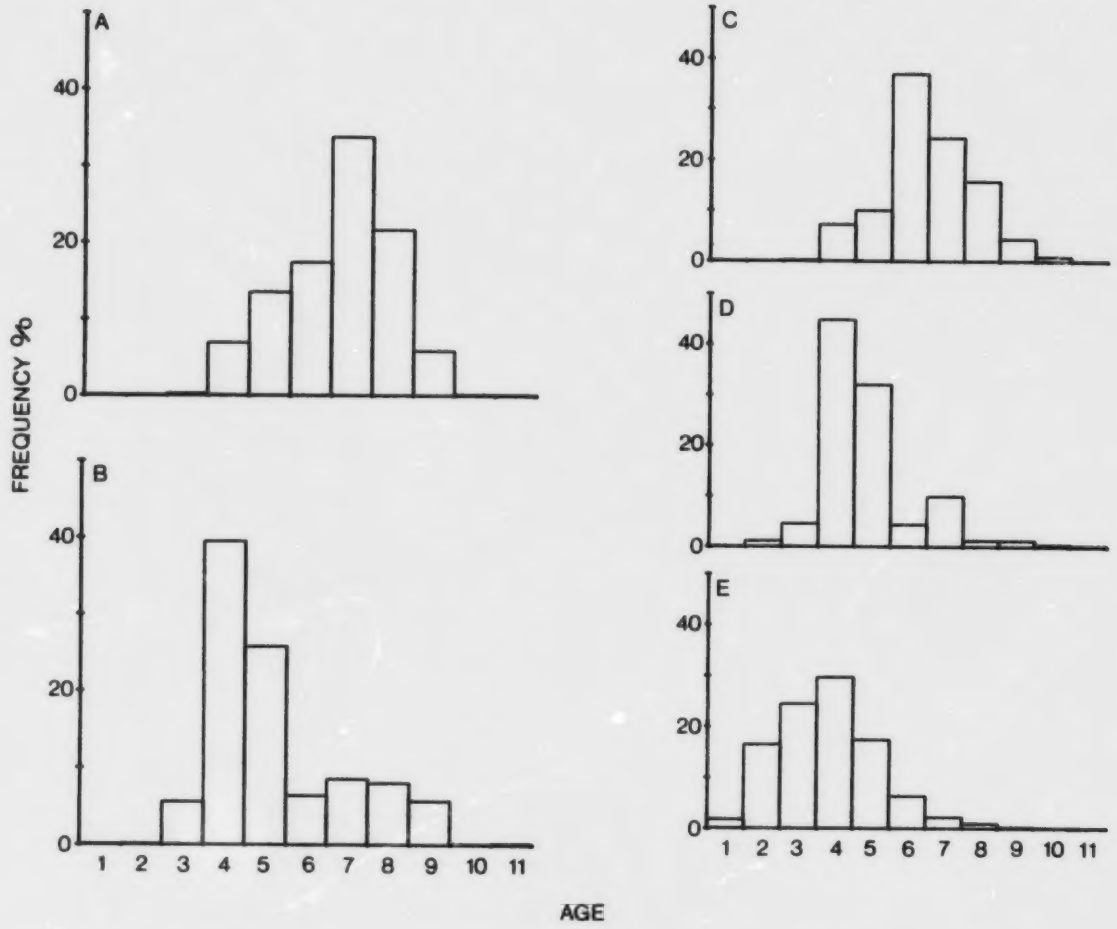

Fig. 53. Age compositions of commercially caught walleyes: A - north summer, B - south summer, C - north fall, D - channel fall, E - south fall.

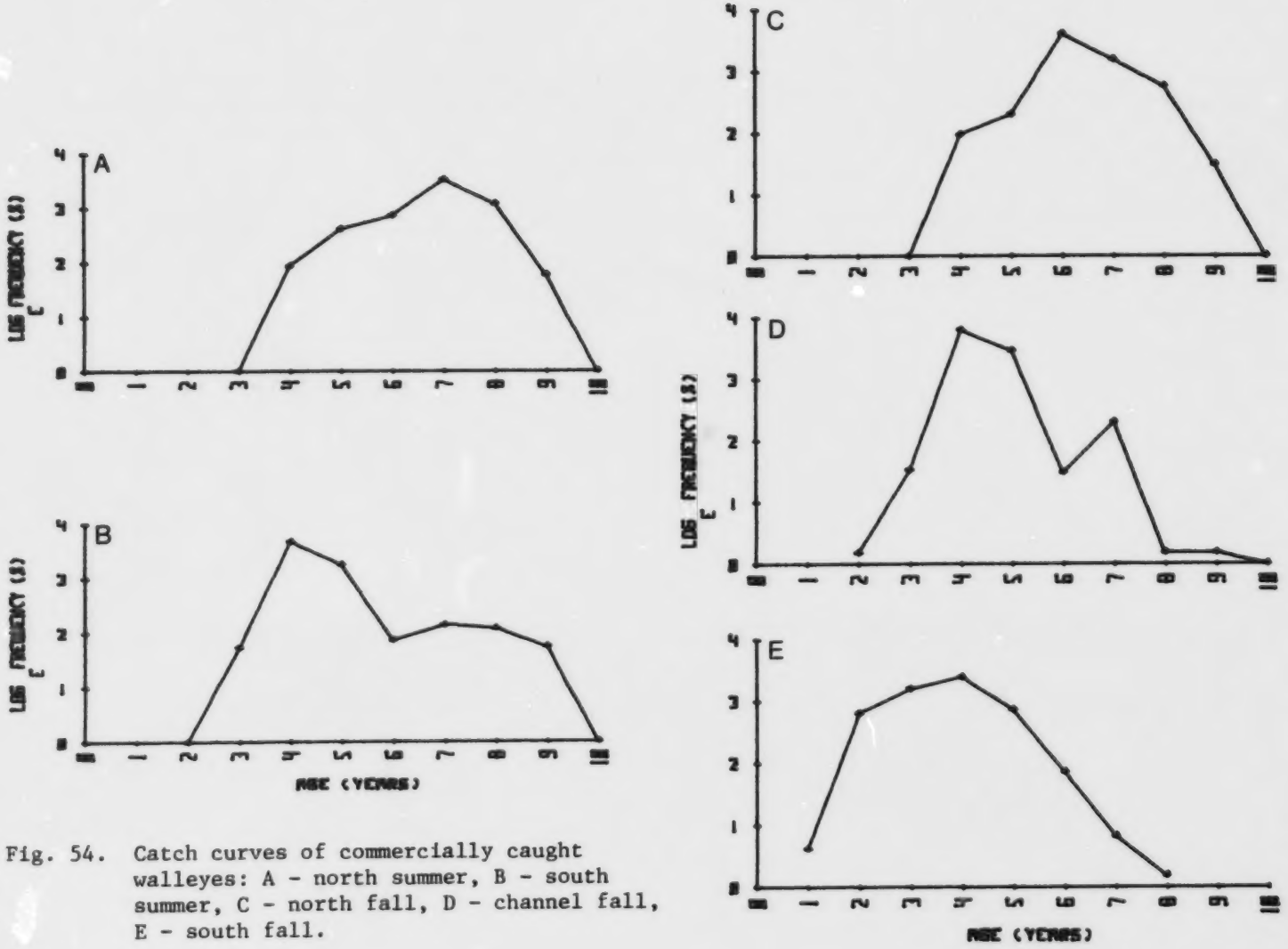

Fig. 54. Catch curves of commercially caught walleyes: A - north summer, B - south summer, C - north fall, D - channel fall, E - south fall.

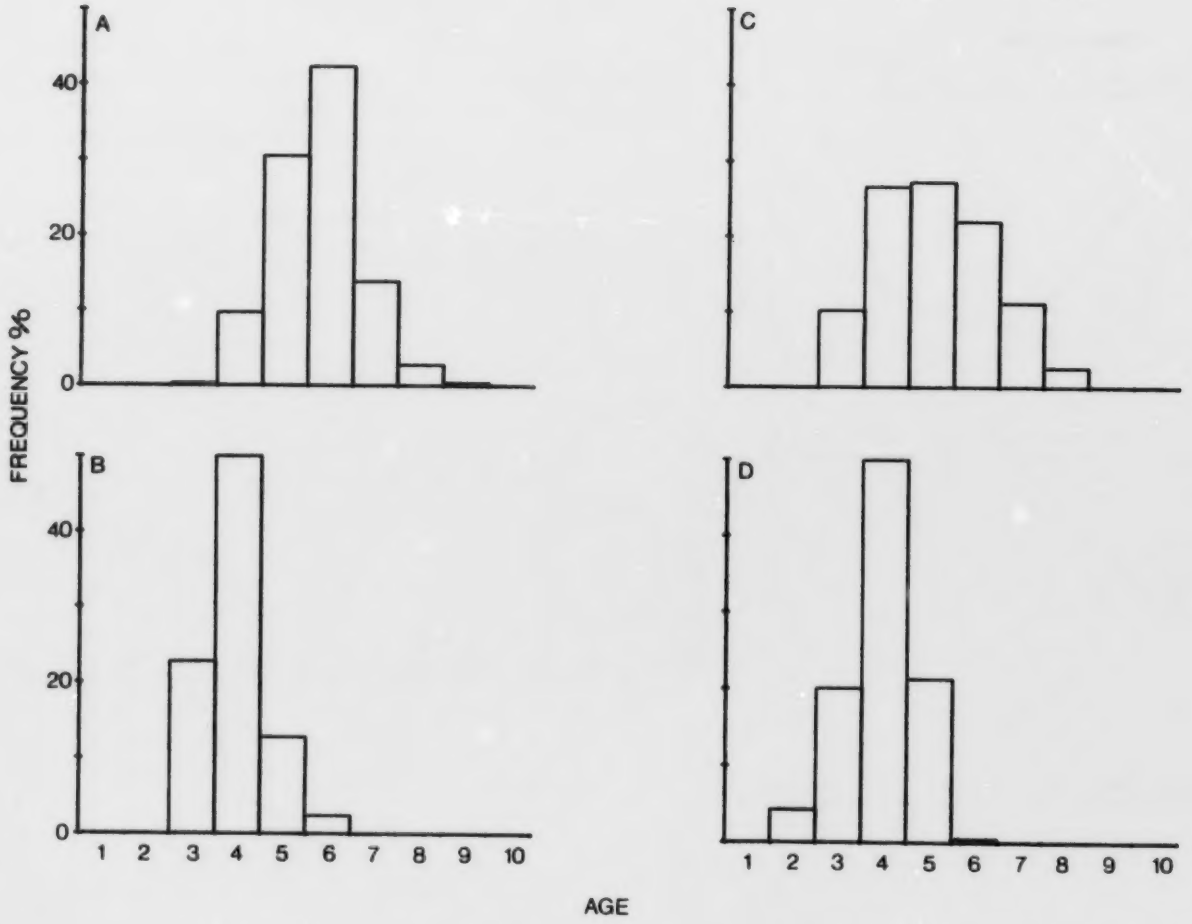

Fig. 55. Age compositions of commercially caught saugers: A - channel summer, B - south summer, C - channel fall, D - south fall.

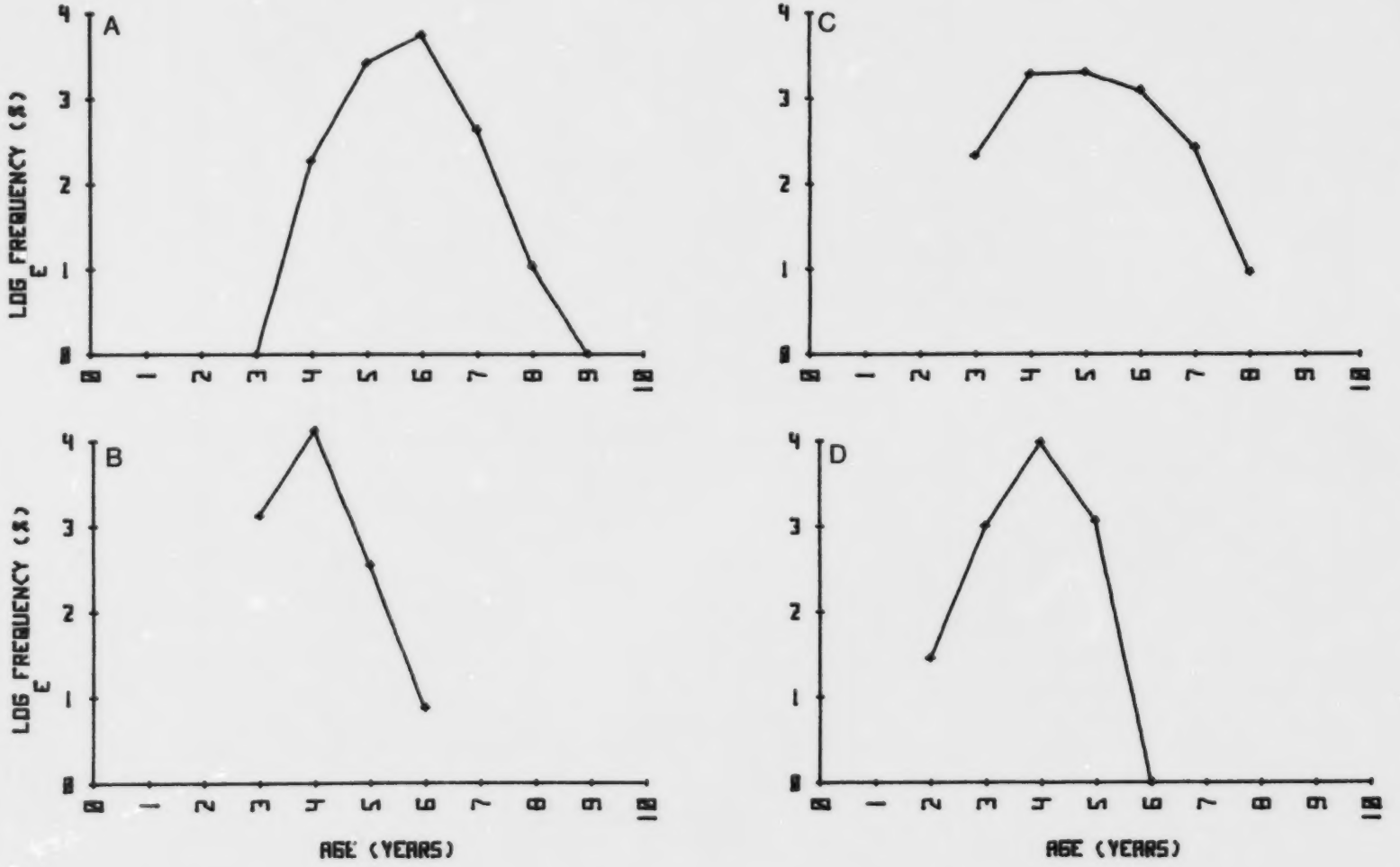

Fig. 56. Catch curves of commercially caught saugers: A - channel summer, B - south summer, C - channel fall, D - south fall.

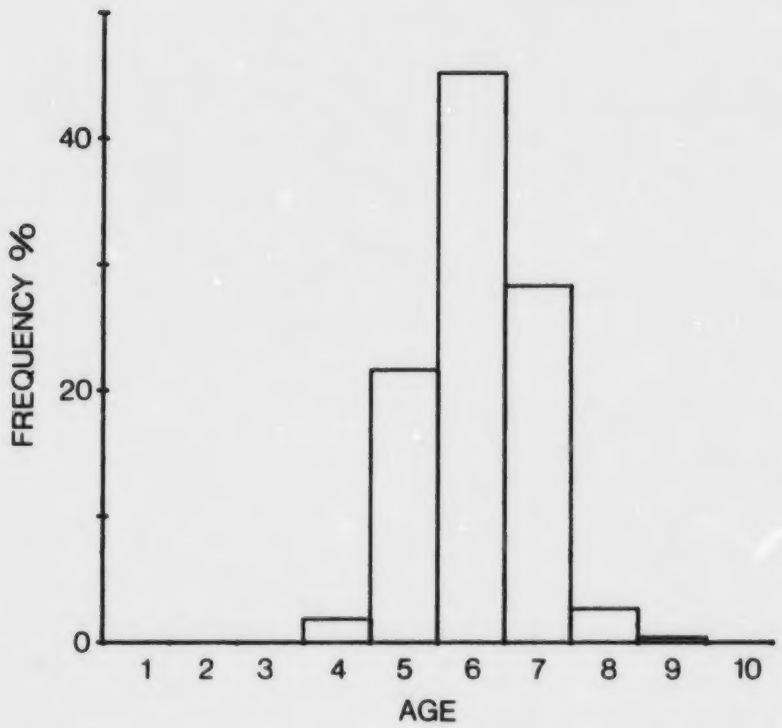

Fig. 57. Age composition of commercially caught whitefish.

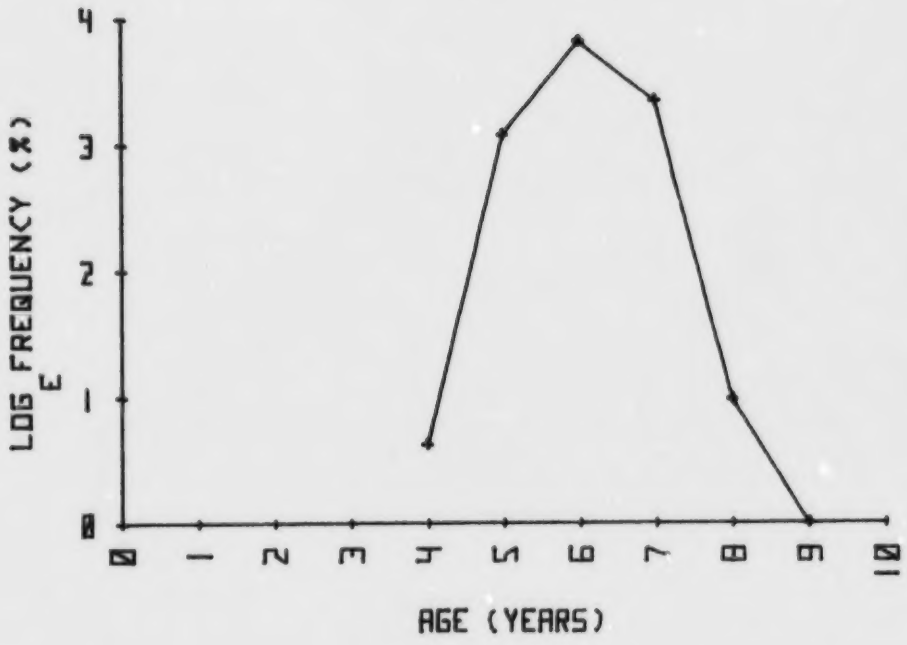

Fig. 58. Catch curve of commercially caught whitefish.

Table 1. 1983 experimental gang locations.

Gang No.	Location	Date
South Basin		
1	Willow Point	May 18
2	Winnipeg Beach	May 25
3	Deer Island	May 31
4	Observation Point	July 5
5	Sandy River	July 5
6	Ironwood Point	July 6
7	Elk Island	July 6
8	Drunken Point	July 8
9	Camp Morton	July 8
10	Balsam Bay	July 13
11	Red River	July 13
12	Pipestone Reef	June 1
13	Anderson Point	June 1
14	Mill Point	June 2
15	Mill Point	June 2
Channel		
16	Bloodvein River	June 3
17	Dowling Reef	June 8
18	Moose Island	June 8
19	Catfish Creek	June 9
20	Berens River	June 15
North Basin		
21	Sturgeon Bay	June 29
22	Gravel Island	June 29
23	Poplar Reef	June 16
24	Merchant's Creek	June 17
25	Big Black River	June 17
26	Warren Landing	June 20
27	Spider Island	June 20
28	Mossy Ranges	June 21
29	Gaps	June 21
30	Deep	June 22
31	Howell Point	June 22
32	Grand Rapids	June 24
33	Gull Bay	June 26
34	Reindeer Island	June 28

Table 2. 1983 commercial sampling schedule.

Major area	Location	Species		
		Walleye	Sauger	Whitefish
South basin	Selkirk	June 7	June 20	
		June 20	Sept. 16	
		Sept. 23	Oct. 4	
	Gimli	June 6	Oct. 17	
		June 21		
		Oct. 13		
		Oct. 25		
Channel	Matheson Is.	Sept. 29	June 7	
		Oct. 6	June 14	
			Sept. 22	
	Berens R.		June 14	
			Sept. 15	
North basin	George Is.			June 15*
	Warren Landing			June 21*
	Big Black R.	Oct. 11		June 18*
	Dauphin R.	June 15		
	Gull Bay	June 24		
	Grand Rapids	June 17		
		Sept. 26		

* dressed weight samples

Table 3. Numbers of unsampled fish from various meshes of the experimental gangs.

Area	Species	Mesh size (inches)			
		3	3.25	3.5	3.75
Channel	sauger	130	96	57	56
North basin	whitefish*		22		

* also whitefish from gang 31 were not sampled.

Table 4. 1983 maturity schedules of Lake Winnipeg walleyes.

Age (years)	No. immature			No. mature			% mature		
	male	female	total	male	female	total	male	female	total
South Basin									
2	1	1	2				0	0	0
3	9	17	26	2	0	2	18.18	0	7.14
4	6	42	48	13	3	3	68.42	6.67	25.00
5		18	18	4	11	15	100.00	37.93	45.45
6		6	6	3	13	16		68.42	72.73
7				1	9	10		100.00	100.00
8				0	2	2			
9									
10					1	1			
sex ratio	0.19 : 1			0.61 : 1			0.32 : 1		
North Basin									
2	1	2	3				0	0	0
3	15	26	41				0	0	0
4	39	99	138	9	0	9	18.75	0	6.12
5	24	95	119	15	2	17	38.46	2.06	12.50
6	3	49	52	8	4	12	72.73	7.55	18.75
7		26	26	1	4	5	100.00	13.33	16.13
8		1	1		3	3		75.00	75.00
9					2	2		100.00	100.00
sex ratio	0.28 : 1			2.2 : 1			0.37 : 1		

Table 5. 1983 maturity schedules of Lake Winnipeg saugers.

Age (years)	No. immature			No. mature			% mature		
	male	female	total	male	female	total	male	female	total
South basin									
1	2	3	5				02	0	0
2	12	11	23	4	0	4	25.00	02	14.81
3	14	48	62	28	4	32	66.67	7.69	34.04
4	0	12	12	23	22	45	100.00	64.71	78.95
5				19	45	64		100.00	100.00
6				4	45	49			
7				1	19	20			
8				0	3	3			
9					1	1			
sex ratio	0.38 : 1			0.57 : 1			0.50 : 1		
Channel									
2				3	0	3	-	-	-
3	0	3	3	9	0	9	100.00	0	75.00
4	1	4	5	22	15	37	95.65	78.95	88.10
5	1	0	1	109	145	254	99.09	100.00	99.61
6				90	230	320	100.00		100.00
7				25	153	178			
8				1	42	43			
9				0	3	3			
sex ratio	0.29 : 1			0.44 : 1			0.44 : 1		
North basin									
2	1	2	3	0	0	0	0	0	0
3	2	7	9	2	1	3	50.00	12.50	25.00
4	1	22	23	20	37	57	45.24	62.71	71.25
5	1	19	20	99	216	315	99.00	91.91	94.03
6	1	5	6	136	338	474	99.27	98.54	98.75
7				47	182	229	100.00	100.00	100.00
8				9	56	65			
9				0	7	7			
10				0	1	1			
sex ratio	0.11 : 1			0.37 : 1			0.36 : 1		

Table 6. 1983 maturity schedules of north basin whitefish.

Age (years)	No. immature			No. mature			% mature		
	male	female	total	male	female	total	male	female	total
2	0	1	1				0	0	0
3	10	14	24				0	0	0
4	300	324	624	9	14	23	2.91	4.14	3.55
5	535	491	1026	110	143	253	17.05	22.56	19.78
6	96	75	171	235	266	501	71.00	78.01	74.55
7	18	17	35	206	211	417	91.96	92.54	92.26
8	1	0	1	46	44	90	97.87	100.00	98.90
9	0	1	1	5	7	12	100.00		
10				1	0	1			
sex ratio	1.04 : 1			0.89 : 1			0.98 : 1		

Table 7. 1983 age-specific maturity curves of Lake Winnipeg walleyes, saugers and whitefish.

Species	Area	Sex	Maturity curve*	R	F ratio and d. f.	Age at 50% mature (years)
Walleye	South basin	Female	Y = - 9.315 + 1.706X	0.989	45.06(1,1)†	5.46
		Combined	Y = - 5.916 + 1.156X	0.996	243.48(1,2)	5.12
	North basin	Male	Y = - 6.437 + 1.224X	0.994	86.88(1,1)†	5.26
		Female	Y = -11.869 + 1.551X	0.956	21.49(1,2)	7.65
		Combined	Y = - 6.112 + 0.796X	0.870	9.36(1,3)	7.68
Sauger	South basin	Male	Y = - 6.017 + 2.293X	0.992	62.91(1,1)†	2.62
		Female[a]	Y = - 8.671 + 2.249X	0.977	21.38(1,1)†	3.86
		Combined	Y = - 4.970 + 1.536X	0.986	35.30(1,1)†	3.24
	Channel	Combined[b]	Y = - 1.677 + 0.923X	1.000	6657.45(1,1)	1.82
	North basin	Female	Y = - 8.417 + 2.188X	0.997	186.30(1,1)	3.85
		Combined	Y = - 6.856 + 1.928X	1.000	1812.41(1,1)	3.56
Whitefish	North basin	Male	Y = -11.610 + 2.031X	0.996	279.59(1,2)	5.72
		Female	Y = -10.862 + 1.948X	0.993	137.04(1,2)	5.58
		Combined	Y = -11.186 + 1.982X	0.995	199.00(1,2)	5.64

* $Y = -\log_e(\frac{100 - Y_i}{Y_i})$ where Y_i = frequency of mature fish in age class i,

X = age (years)

† = non-significant at P = 0.05

a. assuming that 2% of the two year old females are mature

b. assuming that 95% of the five year old saugers are mature

Table 8. Age - specific mean lengths and mean weights of immature and mature male and female walleye from the northern and southern basins of Lake Winnipeg, 1983.

Area	Sex	State of Maturity	Age (years)	Mean length (mm)	1 S.D.	Mean weight (gm)	1 S.D.
North basin	male	immature	2	310.00	-	310.00	-
			3	315.73	16.07	364.67	49.41
			4	339.69	23.83	448.72	91.51
			5	367.17	30.14	589.17	167.80
			6	398.67	45.71	826.67	232.88
		mature	4	354.67	18.97	490.00	62.05
			5	382.40	34.49	644.00	232.96
			6	384.00	24.61	637.50	101.10
			7	448.00	-	940.00	-
	female	immature	2	275.00	9.90	240.00	14.14
			3	323.62	24.31	378.08	75.90
			4	353.25	32.13	531.41	160.43
			5	390.69	31.49	707.16	175.38
			6	424.73	33.14	944.90	216.34
			7	453.77	32.36	1176.54	248.45
			8	438.00	-	1030.00	-
		mature	5	414.00	16.97	840.00	127.28
			6	461.00	15.79	1117.50	109.96
			7	496.00	24.22	1540.00	118.32
			8	510.67	11.55	1663.33	128.58
			9	519.00	15.56	1890.00	212.13
South basin	male	immature	2	226.00	-	90.00	-
			3	318.00	14.39	335.56	39.09
			4	361.00	20.27	526.67	58.54
		mature	3	319.00	29.70	315.00	77.78
			4	346.92	25.93	463.08	110.41
			5	421.50	18.21	887.50	122.03
			6	430.00	12.17	933.33	102.14
			7	486.00	-	1560.00	-
	female	immature	2	244.00	-	140.00	-
			3	340.82	28.59	424.71	94.61
			4	372.57	22.34	600.95	118.67
			5	402.89	22.88	768.33	125.19
			6	424.33	23.37	930.00	135.20
		mature	4	348.00	22.72	480.00	96.44
			5	441.82	25.26	1020.91	160.78
			6	460.00	24.39	1143.85	180.49
			7	508.22	39.92	1564.44	377.69
			8	541.00	15.56	1910.00	353.55
			10	618.00	-	3000.00	-

Table 9. Age - specific mean lengths and mean weights of immature and mature male and female saugers from the three major areas of Lake Winnipeg, 1983.

Area	Sex	State of Maturity	Age (years)	Mean length (mm)	1 S.D.	Mean weight (gm)	1 S.D.
North basin	male	immature	2	192.00	-	120.00	-
			3	254.00	8.49	185.00	49.50
			4	300.00	-	290.00	-
			5	354.00	-	600.00	-
			6	342.00	-	600.00	-
		mature	3	301.00	7.07	310.00	0
			4	319.70	22.93	343.00	81.18
			5	334.51	19.83	413.94	103.18
			6	353.07	20.82	538.68	110.41
			7	376.68	20.57	694.89	129.11
			8	398.89	15.27	923.33	168.37
	female	immature	2	211.00	4.24	100.00	0
			3	255.43	24.70	187.14	54.07
			4	293.09	20.06	278.64	48.43
			5	326.42	20.28	403.16	69.92
			6	342.40	14.59	516.00	70.92
		mature	3	294.00	-	280.00	-
			4	322.00	31.22	374.86	132.70
			5	335.11	21.75	438.24	96.85
			6	362.25	25.02	590.27	134.01
			7	385.53	24.47	746.04	137.13
			8	412.64	24.75	989.11	203.54
			9	429.43	25.68	1152.86	252.11
			10	478.00	-	1570.00	-
Channel	male	immature	4	248.00	-	170.00	-
			5	260.00	-	200.00	-
		mature	2	232.67	14.47	90.00	17.32
			3	256.00	13.11	144.44	15.90
			4	292.82	14.11	234.09	28.23
			5	319.94	14.84	326.33	51.56
			6	345.29	18.00	460.11	98.94
			7	363.12	15.57	572.80	96.20
			8	380.00	-	680.00	-
	female	immature	3	254.00	6.93	136.67	11.55
			4	306.50	20.68	275.00	43.59
		mature	4	304.93	12.42	293.33	46.85
			5	327.26	18.65	403.72	111.42
			6	355.66	23.66	556.96	161.09
			7	378.71	20.96	683.14	146.52
			8	403.10	15.62	857.14	149.00
			9	395.33	29.14	806.67	100.17
South basin	male	immature	1	184.00	0	40.00	0
			2	237.50	41.51	112.50	67.17
			3	270.71	12.27	172.14	32.15
		mature	2	242.00	15.41	115.00	12.91
			3	255.71	16.63	151.79	29.91
			4	293.74	29.18	261.52	74.75
			5	323.16	14.64	333.42	49.64
			6	353.50	5.74	500.00	40.82
			7	358.00	-	540.00	-
	female	immature	1	184.00	13.11	40.00	0
			2	237.27	21.93	104.55	27.34
			3	263.29	23.60	174.38	46.58
			4	290.17	13.95	261.67	37.86
		mature	3	288.00	14.79	275.00	20.82
			4	301.45	11.47	271.36	33.57
			5	329.73	19.58	368.40	66.55
			6	350.36	19.18	478.33	70.87
			7	375.58	24.42	611.84	106.27
			8	413.33	6.43	903.33	46.19
			9	446.00	-	1220.00	-

Table 10. Age - specific mean lengths and mean weights of immature and mature male and female whitefish from the north basin of Lake Winnipeg, 1983.

Sex	State of Maturity	Age (years)	Mean length (mm)	1 S.D.	Mean weight (gm)	1 S.D.
Male	immature	3	287.00	19.19	349.00	81.71
		4	316.42	23.65	460.90	113.04
		5	340.10	22.91	596.47	122.15
		6	367.15	25.43	734.38	145.33
		7	395.67	27.16	928.33	168.50
		8	398.00	-	1110.00	-
	mature	4	346.44	32.69	637.78	188.47
		5	375.21	22.48	794.45	134.73
		6	398.15	21.50	941.36	161.26
		7	415.15	17.93	1092.77	152.24
		8	424.83	33.09	1199.78	226.21
		9	430.40	16.15	1296.00	171.26
		10	424.00	-	1270.00	-
Female	immature	2	232.00	-	180.00	-
		3	287.86	27.85	362.86	141.50
		4	316.38	22.59	464.07	114.27
		5	338.29	20.75	590.84	112.35
		6	368.31	28.85	736.93	159.53
		7	391.18	32.60	871.76	189.65
		9	394.00	-	1100.00	-
	mature	4	363.29	25.16	715.00	131.89
		5	371.87	24.13	792.52	149.80
		6	400.31	22.05	972.14	166.43
		7	419.69	21.37	1155.55	192.59
		8	435.55	23.43	1294.77	191.41
		9	450.86	36.29	1538.57	333.49

Table 11. 1983 size - specific maturity curves of walleyes, saugers and whitefish.

Species	Area	Sex	Maturity curve	R	F ratio and d.F.	Size at 50% mature (mm)
Walleye	North basin	Female	Y = -21.953 + 0.043X	0.880	6.89(1,2)†	510.53
	South basin	Female	Y = -12.441 + 0.028X	0.975	19.29(1,1)†	444.32
Sauger	North basin	Female	Y = -32.495 + 0.104X	0.991	55.86(1,1)†	321.45
	South basin	Female	Y = -18.026 + 0.058X	0.859	2.83(1,1)†	310.79
Whitefish	North basin	Male	Y = -34.185 + 0.088X	0.995	189.75(1,2)	388.47
		Female	Y = -37.295 + 0.096X	0.980	47.77(1,2)	388.49

* $Y = \log_e(\frac{100 - Y}{Y_x}x)$ where Y_x = frequency of mature fish at length x,

X = mean length(mm)

† non-significant at P = 0.05

Table 12. Covariance analyses of northern and southern female walleye and sauger maturity curves.

Species	Maturity curve type			
	Age - specific		Size - specific	
	Slopes F ratio and d.f.	Elevations F ratio and d.f.	Slopes F ratio and d.f.	Elevations F ratio and d.f.
Walleye	0.08(1,3)	39.65 (1,4)*	0.64(1,3)	10.18(1,4)*
Sauger	0.01(1,2)	0.009(1,3)	0.88(1,2)	0.27(1,3)

* significant at P = 0.05

Table 13. Age composition and age - specific mean lengths and mean weights of walleyes from the northern and southern basins of Lake Winnipeg, 1983.

Area	Age (years)	No. fish	Frequency (%)	Mean length (mm)	1 S.E.	Mean weight (gm)	1 S.E.
North	2	3	0.70	286.67	12.35	263.33	24.04
	3	41	9.58	320.73	3.40	373.17	10.47
	4	147	34.35	349.74	2.47	506.94	11.95
	5	136	31.78	385.97	2.79	681.32	15.92
	6	64	14.95	420.69	4.49	911.72	28.65
	7	31	7.24	459.03	6.07	1215.81	47.76
	8	4	0.93	492.50	18.77	1505.00	166.81
	9	2	0.47	519.00	11.00	1890.00	150.00
		Mean age = 4.78					
South	2	2	1.23	235.00	9.00	115.00	25.00
	3	28	17.28	331.93	5.02	388.21	17.05
	4	64	39.51	365.13	3.12	560.31	15.57
	5	33	20.37	418.12	5.03	866.97	30.88
	6	22	13.58	446.18	5.94	1056.82	40.13
	7	10	6.17	506.00	12.11	1564.00	112.61
	8	2	1.23	541.00	11.00	1910.00	250.00
	10	1	0.62	618.00	-	3000.00	-
		Mean age = 4.55					

Table 14. Age composition and age - specific mean lengths and mean weights of Lake Winnipeg saugers, 1983.

Area	Age (years)	No. fish	Frequency (%)	Mean length (mm)	1 S.E.	Mean weight (gm)	1 S.E.
North	2	3	0.25	204.67	6.57	106.67	6.67
	3	12	0.99	266.00	7.83	215.00	19.36
	4	80	6.60	313.20	3.24	339.38	12.19
	5	335	27.64	334.50	1.16	429.55	5.37
	6	480	39.60	359.40	1.10	574.90	5.90
	7	229	18.89	383.72	1.58	735.55	9.04
	8	65	5.36	410.74	2.98	980.00	24.70
	9	7	0.58	429.43	9.71	1152.86	95.29
	10	1	0.08	478.00	-	1570.00	-
		Mean age = 5.87					
Channel	2	3	0.35	232.67	8.35	90.00	10.00
	3	12	1.40	255.50	3.35	142.50	4.29
	4	42	4.91	297.38	2.61	257.62	7.36
	5	255	29.79	323.87	1.12	369.84	6.18
	6	320	37.38	352.74	1.27	529.72	8.53
	7	178	20.79	376.52	1.57	667.64	10.91
	8	43	5.02	402.56	2.41	853.02	22.83
	9	3	0.35	395.33	16.83	806.67	57.83
		Mean age = 5.87					
South	1	5	1.56	184.00	4.15	40.00	0
	2	27	8.44	238.07	5.91	109.63	9.10
	3	94	29.38	263.19	2.17	171.60	4.72
	4	57	17.81	295.96	2.79	265.35	7.16
	5	64	20.00	327.78	2.30	358.02	7.96
	6	49	15.31	350.61	2.63	480.10	9.84
	7	20	6.25	374.70	5.39	608.25	23.41
	8	3	0.94	413.33	3.71	903.33	26.67
	9	1	0.31	446.00	-	1220.00	-
		Mean age = 4.24					

Table 15. Age composition and age - specific mean lengths and mean weights of northern whitefish, 1983.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	1 S.E.	Mean weight (gm)	1 S.E.
2	1	0.03	232.00	-	180.00	-
3	24	0.75	287.50	4.93	357.08	24.13
4	647	20.35	317.83	0.96	470.45	4.81
5	1279	40.22	345.98	0.73	633.25	4.10
6	672	21.13	391.25	1.04	901.16	7.25
7	452	14.21	415.59	1.02	1107.21	8.76
8	91	2.86	429.71	3.06	1244.73	22.37
9	13	0.41	438.62	8.89	1411.54	82.48
10	1	0.03	424.00	-	1270.00	-

Mean age - 5.38

Table 16. Age - specific mean length - weight curves of walleyes, saugers and whitefish from the three major areas of Lake Winnipeg, 1983.

Species	Area	Log_e mean weight = a + b . Log_e mean length	R	Test F ratio and d.f.
Walleye	North	$\log_e Y = -13.015 + 3.283 \log_e X$	1.000	8875.89(1,6)
	South	$\log_e Y = -13.484 + 3.348 \log_e X$	0.999	4532.92(1,6)
Sauger	North	$\log_e Y = -12.825 + 3.266 \log_e X$	0.996	826.22(1,7)
	Channel	$\log_e Y = -17.659 + 4.075 \log_e X$	0.999	5102.95(1,6)
	South	$\log_e Y = -16.185 + 3.817 \log_e X$	1.000	7062.16(1,7)
Whitefish	North	$\log_e Y = -12.178 + 3.187 \log_e X$	0.999	3435.81(1,7)

Table 17. Walford curves of walleyes, saugers and whitefish from Lake Winnipeg, 1983.

Species	Areas		Walford curve $L_{t+1} = a + b \cdot L_t$	L_∞ (mm)	Age classes deleted	R	Test F ratio and d.f.
Walleye	North		Y = 38.284 + 0.987X	2944.92	-	0.999	1699.02(1,5)
	South	A.	Y = 83.079 + 0.930X	1186.84	-	0.970	80.98(1,5)
		B.	Y = 120.136 + 0.820X	667.42	8 - 10	0.971	66.61(1,4)
Sauger	North	A.	Y = 72.828 + 0.886X	638.84	-	0.981	151.85(1,6)
		B.	Y = 97.358 + 0.799X	484.37	9 - 10	0.992	323.22(1,5)
	Channel	A.	Y = 71.927 + 0.848X	473.20	-	0.977	107.09(1,5)
		B.	Y = 106.623 + 0.751X	428.21	2 - 3	0.975	75.83(1,4)
	South	A.	Y = 50.140 + 0.943X	879.65	-	0.992	361.89(1,6)
		B.	Y = 73.873 + 0.848X	486.01	7 - 9	0.991	216.77(1,4)
Whitefish	North		Y = 112.633 + 0.752X	454.17	-	0.979	139.57(1,6)

Table 18. Relationship of $\log_e (L_\infty - \ell_t)$ and t (years) for walleyes, saugers and whitefish, 1983.

Species	Area		$\log_e(L_\infty-\ell_t) = a-b\cdot t$	Age range (years)	R	Test F ratio and d.f.
Walleye	South		$\log_e(667.42-\ell_t) = 6.694 - 0.249t$	2 - 10	0.968	89.78(1,6)
			$\log_e(667.42-\ell_t) = 6.467 - 0.195t$	2 - 8	0.990	252.89(1,5)
Sauger	South		$\log_e(486.01-\ell_t) = 5.873 - 0.162t$	1 - 7	0.998	1276.73(1,5)
	Channel	A.	$\log_e(428.21-\ell_t) = 5.907 - 0.267t$	2 - 7	0.989	182.90(1,4)
		B.	$\log_e(473.20-\ell_t) = 5.966 - 0.203t$	2 - 8	0.992	293.52(1,5)
	North		$\log_e(484.37-\ell_t) = 6.083 - 0.221t$	2 - 9	0.994	514.18(1,6)
Whitefish	North		$\log_e(454.17-\ell_t) = 6.362 - 0.387t$	2 - 9	0.988	250.66(1,6)

Table 19. Exponential and von Bertalanffy growth curves of walleyes, saugers and whitefish from Lake Winnipeg, 1983.

Species	Area	Growth curves					
		Exponential			Von Bertalanffy parameters		
		Log_e length = a+b·log_e age	Age range (years)	R	L_∞ (mm)	k	t_o (years)
Walleye	North	Y = 5.335 + 0.405X	2 - 9	0.990	2944.92	-	-
	South	Y = 5.107 + 0.573X	2 - 10	0.994	667.42	0.195,0.249	-0.187,+0.765
Sauger	North	Y = 5.025 + 0.485X	2 - 10	0.994	484.37	0.221	-0.452
	Channel	Y = 5.154 + 0.391X	2 - 9	0.992	473.20,428.21	0.203,0.267	-0.953,-0.572
	South	Y = 5.184 + 0.390X	1 - 9	0.992	486.01	0.162	-1,930
Whitefish	North A.	Y = 5.204 + 0.402X	2 - 10	0.984	454.17	0.387	+0.631
	B.	Y = 5.204 + 0.412X	3 - 9	0.992			

Table 20. Covariance analyses of walleye and sauger growth curves.

Species	Areas	Curve type	Slopes F ratio and d.F.	Elevations F ratio and d.F.
Walleye	North,South	Exponential	23.53(1,12)	2.18(1,13)*
Sauger	North,Channel,South	Exponential	6.94(2,20)	1.53(2,22)*
Sauger	North,Channel,South	von Bertalanffy	17.48(2,15)	31.28(2,17)

* non significant at P = 0.05

Table 21. Mesh size effects on south basin walleyes.

Parameter	Mesh size (inches)					
	3	3.25	3.5	3.75	4	4.25
No. fish	39	39	28	20	27	9
No. immature	30	23	22	14	8	3
% immature	76.92	58.97	18.57	70.00	29.63	33.33
Mean length(mm)	351.03	378.00	343.21	406.00	436.67	461.56
Mean weight(gm)	511.28	645.38	747.50	799.00	1058.52	1186.67
Age (years)	Frequency (%)					
2			3.57		3.70	
3	46.15	17.95	7.14		3.70	
4	43.59	61.54	46.43	40.00		22.22
5	2.56	7.69	28.57	45.00	37.04	22.22
6	7.69	5.13	3.57	10.00	37.04	44.44
7		5.13	10.71		14.81	11.11
8		2.56		5.00		
9						
10					3.70	
Mean age	3.72	4.26	4.54	4.85	5.67	5.44
Mean biomass net $^{-1}$(kg)	1.329	1.678	1.395	1.065	1.905	0.712
Mean no. fish net^{-1}	2.6	2.6	1.9	1.3	1.80	0.60

Table 22. Mesh size effects on north basin walleyes.

Parameter	Mesh size (inches)							
	3	3.25	3.5	3.75	4	4.25	5	5.25
No. fish	93	101	71	92	35	23	4	9
No. immature	88	91	61	77	32	20	3	8
% immature	94.62	90.10	85.92	83.70	91.43	86.96	75.00	88.89
Mean length(mm)	335.72	361.94	383.01	397.74	421.31	434.43	478.50	428.89
Mean weight(gm)	427.10	568.42	695.35	764.13	954.86	1017.83	1372.50	1110.00
Age (years)	Frequency (%)							
2	2.15	0.99						
3	31.18	5.94	4.23	2.17				11.11
4	44.09	44.55	38.03	23.91	11.43	30.43		11.11
5	19.35	36.63	32.39	45.65	31.43	17.39		11.11
6	2.15	9.90	15.49	19.57	40.00	17.39	75.00	22.22
7	1.08	1.98	8.45	6.52	17.14	30.43	25.00	33.33
8			1.41	2.17				11.11
9						4.35		
Mean age	3.91	4.54	4.90	5.11	5.63	5.65	6.25	5.89
Mean biomass net^{-1}(kg)	2.837	4.101	3.526	5.021	2.387	1.672	0.392	0.714
Mean no. fish net^{-1}	6.6	7.2	5.1	6.6	2.5	1.6	0.3	0.6

Table 23. Mesh size effects on south basin saugers.

Parameter	Mesh size (inches)					
	3	3.25	3.5	3.75	4	4.25
No fish	129	60	50	29	33	19
No. immature	33	11	19	11	22	6
% immature	25.58	18.33	38.00	37.93	66.67	31.58
Mean length(mm)	306.85	318.40	310.60	282.14	262.30	275.79
Mean weight(gm)	307.04	361.92	346.80	254.14	191.52	241.84
Age (years)	Frequency (%)					
1			4.00		9.09	
2	1.55	8.33	6.00	20.69	18.18	26.32
3	24.03	13.33	34.00	41.38	54.55	42.11
4	29.46	10.00	4.00	10.34	12.12	21.05
5	31.01	26.67	12.00	6.00		
6	10.08	33.33	24.00	13.79		
7	3.10	8.33	14.00	6.90	3.03	5.26
8	0.78		2.00		3.03	
9						5.26
Mean age	4.37	4.88	4.52	3.72	3.03	3.47
Mean biomass net^{-1}(kg)	2.641	1.448	1.156	0.491	0.421	0.306
Mean no. fish net^{-1}	8.6	4.0	3.3	1.9	2.2	1.3

Table 24. Mesh size effects on channel saugers.

Parameter	Mesh size (inches)							
	3	3.25	3.5	3.75	4	4.25	5	5.25
No. unsampled fish	130	96	57	56	0	0	0	0
No. sampled fish	248	209	110	96	85	84	16	8
Total no. fish	378	305	167	152	85	84	16	8
No. immature	2	1	2	2	1	1	0	0
% immature	0.81	0.48	1.82	2.08	1.18	1.19	0	0
Mean length(mm)	331.15	341.25	350.67	359.76	362.47	372.60	374.88	321.50
Mean weight(gm)	398.95	448.56	531.18	594.90	624.12	684.17	786.88	402.50
Age (years)	Frequency (%)							
2					2.35	1.19		
3	0.40	1.44	2.73	1.04	2.35	1.19		12.50
4	8.47	3.83	2.73	3.13	3.53	3.57		12.50
5	49.19	30.14	30.00	14.58	12.94	8.33	6.25	50.00
6	30.24	40.67	40.00	45.83	44.71	33.33	31.25	12.50
7	10.08	20.10	20.00	31.25	27.06	38.10	25.00	
8	1.21	3.35	4.55	4.17	7.06	13.10	37.50	12.50
9	0.40	0.48				1.19		
Mean age	5.46	5.86	5.86	6.16	6.05	6.44	6.94	5.13
Mean biomass net^{-1}(kg)	30.161	27.362	17.741	18.085	10.610	11.494	2.518	0.644
Mean no. fish net^{-1}	75.6	61.0	33.4	30.4	17.0	16.8	3.2	1.6

Table 25. Mesh size effects on north basin saugers.

Parameter	Mesh size (inches)							
	3	3.25	3.5	3.75	4	4.25	5	5.25
No. fish	321	302	217	134	117	91	20	10
No. immature	21	18	9	2	7	1	1	2
% immature	6.54	5.96	4.15	1.49	5.98	1.10	5.0	20.00
Mean length(mm)	337.85	346.61	362.15	370.73	375.88	381.32	389.60	362.40
Mean weight (gm)	447.07	513.87	605.21	639.78	716.24	743.96	868.50	705.00
Age (years)	Frequency (%)							
2		0.66	0.46					
3	1.56	1.32	0.92					10.00
4	14.02	5.30	4.15	0.75	4.27	2.20	5.00	10.00
5	44.55	33.77	20.28	15.67	11.11	5.49	20.00	30.00
6	31.15	44.04	43.78	51.49	35.90	40.66	15.00	10.00
7	7.79	13.91	25.35	23.13	33.33	36.26	15.00	10.00
8	0.93	0.99	4.61	7.46	15.38	12.09	35.00	30.00
9			0.46	1.49		3.30	5.00	
10							5.00	
Mean age	5.32	5.65	6.03	6.25	6.44	6.60	6.90	5.90
Mean biomass net^{-1}(kg)	10.251	11.085	9.381	6.124	5.986	4.836	1.241	0.504
Mean no. fish net^{-1}	22.9	21.6	15.5	9.6	8.4	6.5	1.4	0.7

Table 26. Mesh size effects on north basin whitefish.

Parameter	Mesh size (inches)							
	3	3.25	3.5	3.75	4	4.25	5	5.25
No. unsampled fish	0	22	0	0	0	0	0	0
No. sampled fish	277	536	569	471	504	203	265	125
Total no. fish	277	558	569	471	504	203	265	125
No. immature	250	433	405	311	247	203	24	10
% immature	90.25	80.78	71.18	66.03	49.01	100.00	9.06	8.00
Mean length(mm)	321.45	336.42	350.45	356.93	375.82	352.46	410.90	419.41
Mean weight(gm)	483.86	579.79	660.54	703.42	816.73	677.68	1092.45	1153.60
Age (years)	Frequency (%)							
2				0.21				
3	5.78	1.12	0.18	0.21				
4	48.01	37.31	26.54	16.77	9.52	15.27	0.38	1.60
5	35.74	42.16	49.38	49.26	44.84	68.47	10.57	6.40
6	7.22	12.69	17.05	21.02	25.20	13.30	35.85	40.00
7	2.89	4.85	5.80	10.62	17.46	2.96	41.13	41.60
8	0.36	1.87	0.88	1.49	2.98		10.19	6.40
9			0.18	0.42			1.89	4.00
Mean age	4.55	4.88	5.05	5.31	5.60	5.04	6.56	6.57
Mean biomass net^{-1}(kg)	10.310	24.886	28.912	25.485	31.664	10.582	22.269	11.092
Mean no. fish net^{-1}	21.3	42.9	43.8	36.2	38.8	15.6	20.4	9.6

Table 27. Mortality and survival rates of experimentally and commercially caught walleyes, saugers and whitefish from Lake Winnipeg, 1983.

Species	Area	Robson - Chapman			Regression		
		Z	A	S ± 2 S.E.	Z	A	S
Experimental							
Walleye	North	.9574	.6161	.1726 <.3839 <.5952	1.009	.6354	.3646
	South	.8219	.5604	.1998 <.4396 <.6794	0.799	.5502	.4498
Sauger	North	1.5326	.7840	-.0831 <.2160 <.5150	1.677	.8131	.1869
	Channel	1.0455	.6485	.1454 <.3515 <.5576	0.975	.6228	.3772
	South	1.2424	.7113	-.0456 <.2887 <.6230	1.253	.7114	.2856
Whitefish	North	1.029	.6426	.1044 <.3574 <.6105	1.322	.7334	.2666
Commercial summer							
Walleye	North	1.6713	.8120	-.0837 <.1880 <.4597	2.213	.8906	.1094
	South*	.5639	.4310	.3878 <.5690 <.7501	.648	.4769	.5231
Sauger	Channel	1.3287	.7352	.0613 <.2648 <.4683	1.292	.7253	.2747
	South	1.6582	.8095	.0266 <.1905 <.3543	1.626	.8033	.1967
Whitefish	North	2.2942	.8992	-.1042 <.1008 <.3059	2.129	.8913	.1087
Commercial fall							
Walleye	North	.9616	.6177	.1494 <.3823 <.6151	1.086	.6624	.3376
	Channel segment 1*	1.0586	.6531	.1649 <.3469 <.5290	1.160	.6865	.3135
	segment 2*	.6966	.1284	-.1284 <.3034 <.7351	.844	.5700	.4300
	South	1.0288	.6426	.0566 <.3574 <.6583	.907	.5963	.4037
Sauger	Channel	1.1063	.6692	.0584 <.3308 <.6032	1.067	.6560	.3440
	South	1.4694	.7699	.0554 <.2301 <.4047	2.309	.9006	.0994

* significant test Chi square value for Robson - Chapman estimate

Table 28. Age compositions, mean lengths, mean weights and mean weighted ages of commercially caught species from Lake Winnipeg, 1983. Numbers in parentheses are percent frequencies.

Species	Area	Season	Age (years)											Mean length (mm)	Mean weight (gm)	Mean age (years)
			1	2	3	4	5	6	7	8	9	10	11			
Walleye	North	summer			2 (0.27)	52 (6.93)	102 (13.60)	131 (17.47)	254 (33.87)	163 (21.73)	44 (5.87)	1 (0.13)	1 (0.13)	421.97	997.35	6.68
		fall			1 (0.20)	36 (7.20)	50 (10.00)	185 (37.00)	122 (24.40)	79 (15.80)	22 (4.40)	5 (1.00)		443.09	1217.28	6.48
	Channel	fall		6 (1.20)	23 (4.60)	224 (44.80)	160 (32.00)	22 (4.4)	50 (10.00)	6 (1.20)	6 (1.20)	2 (0.40)	1 (0.20)	389.59	745.98	4.78
	South	summer		1 (0.10)	56 (5.62)	393 (39.46)	257 (25.80)	64 (6.43)	85 (8.53)	80 (8.03)	57 (5.72)	1 (0.10)	2 (0.20)	409.37	934.58	5.21
		fall	14 (1.87)	124 (16.53)	184 (24.53)	223 (29.73)	131 (17.47)	48 (6.40)	17 (2.27)	7 (0.93)	2 (0.27)			339.83	527.79	3.79
Sauger	Channel	summer			2 (0.27)	73 (9.73)	229 (30.53)	318 (42.40)	104 (13.87)	21 (2.80)	3 (0.40)			345.86	514.08	5.70
		fall			51 (10.22)	133 (26.65)	136 (27.25)	110 (22.04)	56 (11.22)	13 (2.61)				332.71	435.43	5.05
	South	summer			57 (22.80)	155 (62.00)	32 (12.80)	6 (2.40)						286.35	274.08	3.95
		fall		32 (4.27)	151 (20.16)	402 (53.67)	160 (21.36)	4 (0.53)						305.69	323.58	3.94
Whitefish	North	summer				14 (1.87)	162 (21.60)	339 (45.20)	212 (28.27)	20 (2.67)	3 (0.40)			412.97	1079.45	6.10

Table 29. Differences between mean ages of commercially caught fish and mean ages of maturity.

Species	Area	Season	A. Mean age of commercial catch (years)	B. Age at 50% mature (years)	Difference A - B (years)
Walleye	North	Summer	6.68	7.68	-1.00
		Fall	6.48	7.68	-1.20
	Channel	Fall	4.78	-	-
	South	Summer	5.21	5.12	0.09
		Fall	3.79	5.12	-1.33
Sauger	Channel	Summer	5.70	1.82	3.88
		Fall	5.05	1.82	3.23
	South	Summer	3.95	3.24	0.71
		Fall	3.94	3.24	0.70
Whitefish	North	Summer	6.10	5.64	0.46

* combined sexes values from Table 7

APPENDIX A

COMMERCIAL AGE COMPOSITIONS

Table A1. Gimli walleyes, June 6

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
4	10	4.07	405.20	868.00
5	19	7.72	464.74	1308.42
6	20	8.13	480.20	1323.00
7	65	26.42	505.72	1646.15
8	74	30.08	517.05	1729.73
9	55	22.36	524.58	1835.64
10	1	0.41	636.00	3200.00
11	2	0.81	625.00	3200.00
			505.52	1648.62

Mean age = 5.4349
Z = 2.5028
A = .9181
S = .0819
2S.E. = .1086

Table A2. Gimli walleyes, June 21.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	11	4.40	340.91	500.00
4	132	52.80	358.86	576.06
5	81	32.40	405.09	872.59
6	23	9.20	493.22	1417.39
7	3	1.20	495.33	1526.67
			387.05	757.60

Mean age = 6.0

Z = 1.5231

A = .7820

S = .2180

2S.E. = .1144

Table A3. Gimli walleyes, Oct. 13.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
1	10	4.00	254.80	228.00
2	26	10.40	318.62	381.54
3	80	32.00	305.35	351.75
4	60	24.00	317.47	427.33
5	50	20.00	327.84	508.60
6	16	6.40	343.00	563.75
7	4	1.60	520.00	1860.00
8	3	1.20	548.67	1940.00
9	1	0.40	612.00	2740.00
			322.10	465.72

Mean age = 3.796

Z = .7833

A = .5431

S = .4569

2S.E. = .1054

Table A4. Gimli walleyes, Oct. 25.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
1	4	1.60	276.50	280.00
2	29	11.60	335.72	452.41
3	66	26.40	308.12	367.58
4	93	37.20	340.99	507.96
5	43	17.20	372.47	683.72
6	9	3.60	324.44	480.00
7	6	2.40	418.00	1253.33
			337.34	507.92

Mean age = 3.772

Z = 1.2459

A = .7123

S = .2877

2S.E. = .1656

Table A5. Selkirk walleyes, June 7.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	7	2.80	339.14	520.00
4	145	58.00	377.67	696.83
5	80	32.00	404.33	857.50
6	10	4.00	439.60	1020.00
7	7	2.80	474.00	1317.14
8	1	0.40	388.00	820.00
			390.34	774.08

Mean age = 4.472

Z = 1.4955

A = .7759

S = .2241

2S.E. = .1204

Table A6. Selkirk walleyes, June 20.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
2	1	0.40	254.00	200.00
3	38	15.20	323.84	417.37
4	106	42.40	347.70	516.42
5	77	30.80	360.10	568.05
6	11	4.40	435.27	1087.27
7	10	4.00	404.20	846.00
8	5	2.00	406.80	912.00
9	2	0.80	509.00	1420.00
			356.10	569.44

Mean age = 4.476

Z = 1.0594

A = .6533

S = .3467

2S.E. = .1213

Table A7. Selkirk walleyes, Sept. 23.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
2	69	27.60	339.04	443.19
3	38	15.20	370.00	607.11
4	70	28.00	364.71	622.57
5	38	15.20	384.58	796.05
6	23	9.20	338.70	576.52
7	7	2.80	305.71	341.43
8	4	1.60	482.50	1735.00
9	1	0.40	552.00	2360.00
			360.04	609.72

Mean age = 3.8

Z = .8362

A = .5667

S = .4333

2S.E. = .1440

Table A8. Matheson Island walleyes, Sept. 29.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
2	2	0.80	317.00	345.00
3	8	3.20	351	478.75
4	119	47.60	372.54	588.40
5	84	33.60	386.88	695.71
6	15	6.00	437.20	1036.00
7	15	6.00	495.60	1544.67
8	1	0.40	482.00	1450.00
9	3	1.20	481.33	1566.67
10	2	0.80	512.00	2010.00
11	1	0.40	390.00	740.00
			390.42	730.40

Mean age = 4.74

Z = 1.0033

A = .6333

S = .3667

2S.E. = .5928

Table A9. Matheson Island walleyes, Oct. 6.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
2	4	1.60	326.25	375.00
3	15	6.00	342.27	460.00
4	105	42.00	359.22	530.29
5	76	30.40	369.84	585.79
6	7	2.80	470.86	1345.71
7	35	14.00	496.29	1576.86
8	5	2.00	524.80	2118.00
9	3	1.20	544.67	2196.67
			388.76	761.56

Mean age = 4.828
Z = 1.5339
A = .7843
S = .2157
2S.E. = .1799

Table A10. Grand Rapids walleyes, June 17.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
5	7	2.80	345.14	545.71
6	13	5.20	418.00	933.85
7	75	30.00	419.41	940.27
8	114	45.60	436.64	1085.09
9	39	15.60	448.69	1213.85
10	1	0.40	422.00	1120.00
11	1	0.40	462.00	1320.00
			429.86	1039.84

Mean age = 7.688
Z = 1.5169
A = .7806
S = .2194
2S.E. = .0952

Table A11. Grand Rapids walleyes, Sept. 26.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
5	6	2.40	408.67	941.67
6	40	16.00	414.55	1009.25
7	103	41.20	438.02	1186.02
8	75	30.00	466.16	1460.93
9	21	8.40	486.67	1659.05
10	5	2.00	528.80	2166.00
			447.90	1293.68

Mean age = 7.32
Z = 1.4102
A = .7559
S = .2441
2S.E. = .1212

Table A12. Dauphin River walleyes, June 15.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
4	29	11.60	312.83	366.21
5	65	26.00	351.26	530.15
6	64	25.60	386.44	710.94
7	51	20.40	452.82	1213.73
8	38	15.20	485.42	1420.00
9	3	1.20	471.33	1313.33
			398.36	841.52

Mean age = 6.052
Z = .6231
A = .4637
S = .5363
2S.E. = .1019

Table A13. Gull Bay walleyes, June 24.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	2	.8	276.00	250.00
4	23	9.2	321.30	430.00
5	30	12	413.47	875.33
6	54	21.6	436.19	1048.70
7	128	51.2	462.70	1293.98
8	11	4.4	481.09	1416.36
9	2	.8	500.00	1590.00
			437.67	1110.68

Mean age = 6.296

Z = 2.3289

A = .9026

S = .0974

2S.E. = .0754

Table A14. Big Black River walleyes, Oct. 11

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	1	0.40	408.00	740.00
4	36	14.40	388.67	773.33
5	44	17.60	421.05	1001.14
6	145	58.00	449.96	1226.41
7	19	7.60	467.16	1385.26
8	4	1.60	501.50	1635.00
9	1	0.40	516.00	1900.00
			438.27	1140.88

Mean age = 5.644
Z = 1.8954
A = .8497
S = .1503
2S.E. = .0810

Table A15. Selkirk saugers, June 20.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	57	22.80	269.05	223.51
4	155	62.00	284.10	266.71
5	32	12.80	317.88	359.38
6	6	2.40	340.67	490.00
			286.35	274.08

Mean age = 3.948
Z = 1.6582
A = .8095
S = .1905
2S.E. = .0819

Table A16. Selkirk saugers, Sept. 16.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	13	5.20	278.46	216.92
4	136	54.40	305.26	311.18
5	98	39.20	320.82	378.27
6	3	1.20	341.33	456.67
			310.40	334.32

Mean age = 4.364

Z = 3.5165

A = .9703

S = .0297

2S.E. = .0534

Table A17. Selkirk saugers, Oct. 4.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	28	11.24	299.50	294.64
4	162	65.06	311.15	331.79
5	58	23.29	323.59	371.90
6	1	0.40	314.00	370.00
			312.75	337.11

Mean age = 4.361
Z = 4.0813
A = .9831
S = .0169
2S.E. = .0529

Table A18. Gimli saugers, Oct. 17.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
2	32	12.80	241.19	160.00
3	110	44.00	289.15	282.18
4	104	41.60	313.37	354.62
5	4	1.60	343.00	450.00
			293.94	299.36

Mean age = 3.32
Z = 3.2958
A = .9630
S = .0370
2S.E. = .0575

Table A19. Matheson Island saugers, June 7.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	2	0.80	299.00	310.00
4	70	28.00	315.17	357.71
5	112	44.80	332.56	425.00
6	55	22.00	347.38	508.00
7	11	4.40	368.55	720.00
			332.27	436.48

Mean age = 5.012
Z = 1.1534
A = .6844
S = .3156
2S.E. = .0960

Table A20. Matheson Island saugers, June 14.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
4	1	0.40	298.00	280.00
5	58	23.20	319.17	368.62
6	131	52.40	338.05	450.69
7	47	18.80	360.34	561.28
8	11	4.40	409.64	890.91
9	2	0.80	459.00	1230.00
			341.82	477.36

Mean age = 6.06

Z = 1.5824

A = .7945

S = .2055

2S.E. = .1502

Table A21. Matheson Island saugers, Sept. 22.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	50	20.00	275.52	198.00
4	115	46.00	307.88	293.48
5	78	31.20	331.41	376.28
6	7	2.80	354.29	504.29
			310.05	306.12

Mean age = 4.168
Z = 2.4967
A = .9176
S = .0824
2S.E. = .0943

Table A22. Berens River saugers, June 14.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
4	2	0.80	343.00	500.00
5	59	23.60	350.15	562.37
6	132	52.80	363.62	620.45
7	46	18.40	374.78	695.65
8	10	4.00	390.00	822.00
9	1	0.40	392.00	800.00
			363.50	628.40

Mean age = 6.024
Z = 1.7346
A = .8325
S = .1765
2S.E. = .1472

Table A23. Berens River saugers, Sept. 15.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
3	1	0.40	258.00	220.00
4	18	7.23	290.78	285.56
5	58	23.29	325.93	409.66
6	103	41.37	360.25	575.63
7	56	22.49	386.29	723.57
8	13	5.22	413.38	909.23
			355.45	565.26

Mean age = 5.7832
Z = 1.0782
A = .6598
S = .3402
2S.E. = .0985

Table A24. George Island whitefish (dressed weight), June 15.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
4	5	2.00	362.00	746.00
5	66	26.40	392.52	934.39
6	101	40.40	414.83	1060.40
7	70	28.00	432.83	1226.29
8	6	2.40	445.33	1366.67
9	2	0.80	456.00	1720.00
			413.98	1079.92

Mean age = 6.048
Z = 2.1518
A = .8837
S = .1163
2S.E. = .1086

Table A25. Big Black River whitefish (dressed weight), June 18.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
4	7	2.80	358.57	740.00
5	56	22.40	390.82	956.43
6	129	51.60	417.75	1140.08
7	52	20.80	424.38	1227.69
8	5	2.00	448.00	1456.00
9	1	0.40	424.00	1420.00
			412.07	1113.40

Mean age = 5.98
Z = 2.2130
A = .8906
S = .1094
2S.E. = .1230

Table A26. Warren Landing whitefish (dressed weight), June 21.

Age (years)	No. fish	Frequency (%)	Mean length (mm)	Mean weight (gm)
4	2	0.80	369.00	810.00
5	40	16.00	398.65	933.75
6	109	43.60	413.49	1037.98
7	90	36.00	418.22	1093.56
8	9	3.60	424.44	1192.22
			412.86	1045.04

Mean age = 6.256
Z = 2.3979
A = .9091
S = .0909
2S.E. = .0914